

U.S.C.G. Merchant Marine Exam

OSV – Chief Engineer

Q684 Electrical – Electronic – Control Engineering

(Sample Examination)

Choose the best answer to the following Multiple-Choice Questions:

1. What are the operational characteristics of the two alternators with the speed droop curves shown in figure "A" of the illustration? Illustration EL-0025
- A. machine "A" and machine "B" are both droop machines
 - B. machine "A" and machine "B" are both isochronous machines
 - C. machine "A" is a droop machine, while machine "B" is an isochronous machine
 - D. machine "A" is an isochronous machine, while machine "B" is a droop machine

Correct answer: C

2. In preparation for paralleling generators, if the electric plant condition is as shown by graph "A", what would be the rotational status of the synchronizing lamps as shown in circuit "B"? Illustration EL-0002
- A. Revolve rapidly in the slow direction
 - B. Revolve slowly in the fast direction
 - C. Revolve slowly in the slow direction
 - D. Remain stationary

Correct answer: B

3. In addition to insulating the outboard bearing pedestal to prevent shaft currents in an alternator, what else must be insulated?
- A. Exciter bearings that make a connection to the alternator outboard bearing pedestal must also be insulated. No such requirement exists for lube oil piping connections.
 - B. BOTH lube oil piping connections AND exciter bearings that make a connection to the alternator outboard bearing pedestal must also be insulated.
 - C. The lube oil piping connections that make a connection to the alternator outboard bearing pedestal must also be insulated. No such requirement exists for exciter bearings.
 - D. BOTH lube oil piping connections AND exciter bearings that make a connection to the alternator inboard bearing pedestal must also be insulated.

Correct answer: B

4. What is the correct methodology to prevent shaft currents in an alternator?
- A. Insulating EITHER the inboard bearing shell OR the inboard bearing pedestal
 - B. Insulating EITHER the outboard bearing shell OR the outboard bearing pedestal
 - C. Insulating BOTH the inboard AND outboard bearing shells
 - D. Insulating BOTH the inboard AND outboard bearing pedestals

Correct answer: B

5. As shown in the illustrated alternator protection scheme diagram, what device provides the input to the overcurrent inverse time relay "OCIT", the overcurrent instantaneous trip "OC (inst.)", and the negative phase sequence relay "NPS"? Illustration EL-0067
- A. potential transformer
 - B. thermal monitor sensors
 - C. current transformer
 - D. infrared sensors

Correct answer: C

6. As shown in the illustrated diagnostic setup for locating a shorted field coil of a ten-pole salient pole alternator, if 240 VAC/60 Hz is applied across the brushes, what would be the voltage drop across field coil No.4 if that field coil had shorted turns and the other field coils were free of shorts?
Illustration EL-0202

- A. 17 VAC
- B. 24 VAC
- C. 25 VAC
- D. 32 VAC

Correct answer: A

7. As shown in the illustration, what type of motor is controlled as depicted in both figure "A" and in figure "B"? Illustration EL-0144

- A. single-phase wound rotor induction motor
- B. three-phase wound rotor induction motor
- C. three-phase squirrel cage induction motor
- D. three-phase synchronous motor

Correct answer: B

8. As shown in the illustration, what type of motor and motor starter are featured? Illustration EL-0137

- A. non-reversing squirrel cage induction motor with reduced voltage autotransformer starting
- B. non-reversing squirrel cage induction motor with reduced voltage primary reactor starting
- C. reversing squirrel cage induction motor with across-the-line starting
- D. reversing squirrel cage induction motor with reduced voltage autotransformer starting

Correct answer: A

9. With what kind of starting equipment are most three-phase induction motors of five horsepower or less started?

- A. across-the-line starters
- B. reactor starters
- C. autotransformer starters
- D. resistor starters

Correct answer: A

10. Which of the following statements is true concerning the cleaning of electrical contacts?

- A. Magnetic brushes should be used to remove metallic dust.
- B. Delicate parts should be cleaned with a brush and an approved safety solvent.
- C. The contact surfaces should be greased to increase contact resistance.
- D. Compressed air should be used to blow out metallic dust.

Correct answer: B

11. By what means should motor controller contacts be routinely cleaned?

- A. wiping with a clean dry cloth
- B. dressing with crocus cloth
- C. filing with a bastard file
- D. blowing with compressed air

Correct answer: A

12. As shown in the illustration, what mechanism will disconnect the motor from the line in case of a sustained motor overload? Illustration EL-0080
- A. overload relay heaters and overload relay NC contacts (OL)
 - B. transformer primary fuses FU4 and FU5
 - C. disconnect switch fuses FU1, FU2, and FU3
 - D. transformer secondary fuses FU6 and FU7

Correct answer: A

13. If a digital multimeter is set up as shown in figure "A" of the illustration to test an AC contactor coil, what would the display read if the coil is open-circuited? Illustration EL-0214
- A. 0.03 ohms
 - B. 22 ohms
 - C. OL ohms
 - D. 110 V

Correct answer: C

14. Which of the following is a disadvantage of electric drive propulsion systems?
- A. Propulsion motors are required along with electrical power generation machinery.
 - B. Location of electric power generation machinery is flexible.
 - C. Main propulsion power may also be directed to ships electrical service distribution.
 - D. The propeller speed and direction of rotation are easily controllable.

Correct answer: A

15. As shown in figure "B" of the illustration, what statement is true concerning "regenerating" operation? Illustration EL-0162
- A. by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor
 - B. by applying torque in the opposite direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor
 - C. by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly slows down the motor
 - D. by applying torque in the same direction of rotation direction, the motor briefly regenerates power back into the mains, which rapidly speeds up the motor

Correct answer: A

16. How is the main propeller shaft rotation of a conventional AC turbo-electric drive normally reversed? (Assume that no converters or inverters are used.)
- A. reversing the steam turbine direction of rotation
 - B. reversing the phase sequence applied to the AC propulsion motor
 - C. reversing the field polarity of the AC propulsion generator
 - D. reversing the field polarity of the AC propulsion motor

Correct answer: B

17. An AC diesel-electric drive ship with synchronous propulsion motors has the capability for power factor correction. If the power factor associated with the main power distribution including all motors is 0.7 leading, what statement is true?
- A. The synchronous propulsion motors are normally excited.
 - B. The excitation status of the synchronous motor cannot be determined.
 - C. The synchronous propulsion motors are under-excited.
 - D. The synchronous propulsion motors are over-excited.

Correct answer: D

18. What type of motor is generally used in DC propulsion drive systems?
- A. shunt wound
 - B. differentially compounded
 - C. series wound
 - D. permanent magnet

Correct answer: A

19. On DC diesel-electric drives, how is the speed of the DC propulsion motor primarily controlled?
- A. changing the motor field excitation current
 - B. changing the polarity of the generator field
 - C. changing the generator field excitation current
 - D. changing the generator engine speed

Correct answer: D

20. Refer to the two-generator, two-motor, DC diesel-electric drive propulsion system simplified schematic shown in the illustration. While in two-generator, two-motor operation, which of the following conditions would cause the propulsion shaft speed to be approximately one-half the desired speed? Illustration EL-0141
- A. The armature winding of one of the propulsion generators is open-circuited.
 - B. The field winding of one of the propulsion motors is open-circuited.
 - C. The armature winding of one of the propulsion motors is open-circuited.
 - D. The field winding of one of the propulsion generators is open-circuited.

Correct answer: D

21. Due to the operating characteristics of the system, time lag fuses (or dual-element fuses) are necessary for use in what types of circuits?
- A. motor starting circuits
 - B. emergency lighting circuits
 - C. main lighting circuits
 - D. general alarm circuits

Correct answer: A

22. As shown in figures "E" and "F" of the pictured high voltage rack mounted circuit breaker, which figure represents the circuit breaker position when in the open or tripped position? Illustration EL-0167
- A. A
 - B. B
 - C. C
 - D. D

Correct answer: C

23. What is the purpose of the device labeled "Man-Auto Sw." in the illustrated switchboard? Illustration EL-0003
- A. to enable the operator to read the field voltage on device "Volt. Reg. Adj. Pot." or device "Man. Volt. Adj. Rheo."
 - B. to shift the governor control from manual to automatic/zero droop or vice versa
 - C. to supply regulated control power to the switchboard
 - D. to shift from the automatic voltage regulator to manual voltage control or vice versa

Correct answer: D

24. Why is it necessary to perform periodic testing of correctly rated and properly installed circuit breakers?
- A. to insure they can trip faster as they increase in age
 - B. to insure they will be able to withstand at least 125% of applied voltage
 - C. to insure they do not exceed their interrupting capacity
 - D. to insure they will continue to provide the original degree of protection

Correct answer: D

25. Which of the following procedures should be used to maintain a large electric motor during periods of inactivity?
- A. Compressed air should be blown over areas where dust is deposited.
 - B. Space heaters should be used to prevent condensation of moisture.
 - C. Spraying a solvent periodically to remove carbon dust
 - D. A thin layer of air-drying varnish should be applied on the windings.

Correct answer: B

26. A resistance in a circuit of unknown value is to be tested using the voltmeter/ammeter method. How should the two meters be connected?
- A. the ammeter in series and the voltmeter in parallel with the resistance
 - B. the ammeter in parallel and the voltmeter in series with the resistance
 - C. both meters in series with the resistance
 - D. both meters in parallel with the resistance

Correct answer: A

27. When measuring DC current flow using an analog or digital multimeter set up as a milliammeter, how is the meter connected?
- A. insuring correct polarity
 - B. in parallel with the power source and load
 - C. using the lowest range possible to prevent instrument damage
 - D. in series with the power source and load

Correct answer: D

28. As shown in figure "D" of the illustrated digital power meter, what type of single-phase load is under test for power measurement? Illustration EL-0256
- A. a purely inductive load
 - B. a resistive-capacitive load
 - C. a purely resistive load
 - D. an inductive-resistive load

Correct answer: D

29. How should the shunt used in an ammeter be connected?
- A. in parallel with the load and in parallel with the meter movement
 - B. in series with the load and in series with the meter movement
 - C. in series with the load and in parallel with the meter movement
 - D. in parallel with the load and in series with the meter movement

Correct answer: C

30. To properly use a clamp-on type ammeter to check current flow, what must be done FIRST?
- A. short the test leads and calibrate the instrument to zero
 - B. connect the voltage test leads to the appropriate terminals
 - C. hook the jaws of the instrument around the insulated single conductor
 - D. de-energize the circuit to allow connection of the instrument in series

Correct answer: C

31. In what situation would an electrical phase sequence indicator be useful?
- A. preparing to parallel alternators
 - B. connecting lighting branch circuits
 - C. connecting shore power lines to the ship
 - D. troubleshooting DC motors

Correct answer: C

32. Which of the illustrated resistors represents the schematic symbol shown in figure "B"? Illustration EL-0021
- A. figure "4"
 - B. figure "6"
 - C. figure "10"
 - D. figure "11"

Correct answer: C

33. Which of the following electrical schematic symbols represents a normally closed flow switch?
Illustration EL-0059

- A. 6
- B. 7
- C. 11
- D. 14

Correct answer: A

34. As shown in figure "B" of the illustration, if the source voltage at the branch circuit breaker is 220 VAC, what would be the applied voltage to the load? Illustration EL-0083

- A. 55 volts
- B. 110 volts
- C. 165 volts
- D. 220 volts

Correct answer: A

35. To check the three-line fuses protecting a three-phase motor using a multimeter set up as a voltmeter, what should be done FIRST?

- A. place the leads across the bottom ends of the fuses
- B. make sure the motor is operating at full load to guard against a false reading
- C. place the leads across the "hot" ends of the fuses
- D. place the starter in the "stop" position

Correct answer: D

36. In addition to short circuits and sustained overloads, in what other situation are fuses likely to blow?

- A. low ambient temperatures
- B. low fuse holder clip to fuse contact resistance
- C. loose fuse holder clips
- D. oversized fuses in terms of amp rating

Correct answer: C

37. In order to definitively determine whether or not fuse "1", shown in the illustration is blown using an on-line testing technique, across what points would you connect the voltmeter leads? Illustration EL-0062

- A. from the top of fuse "1" and the bottom of either fuse "2" or fuse "3"
- B. from the bottom of fuse "1" and the bottom of either fuse "2" or fuse "3"
- C. from the bottom of fuse "1" and the top of either fuse "2" or fuse "3"
- D. from the top of fuse "1" and the top of either fuse "2" or fuse "3"

Correct answer: C

38. In the lighting distribution circuit shown in the illustrated lighting panel L110 of the illustration, if all circuit breakers are closed and due to a problem with the relevant feeder circuit breaker, there is a loss of power on the incoming phase A, which of the following statements is true? Illustration EL-0013
- A. All of the receptacles in the laundry would lose power.
 - B. Half of the passageway lighting circuits on the 01 deck would lose power.
 - C. Half of the accommodation lighting circuits on the 01 deck, port side would lose power.
 - D. All of the accommodation lighting circuits on the 01 deck, starboard side would lose power.

Correct answer: C

39. Which of the following expresses the relationship of the AC input frequency and DC ripple output frequency in a full wave rectifier?
- A. The output ripple frequency is the same as input frequency.
 - B. The output ripple frequency is four times the input frequency.
 - C. The output ripple frequency is twice the input frequency.
 - D. The output ripple frequency is one-half the input frequency.

Correct answer: C

40. As shown in figure "C" of the illustration, what are the purposes of the coupling capacitor C_c and the bypass capacitor C_{bp} respectively? Illustration EL-0045
- A. C_c blocks any AC component associated with the input from reaching the base. C_{bp} helps maximize degeneration of the AC output signal.
 - B. C_c blocks any AC component associated with the input from reaching the base. C_{bp} helps minimize degeneration of the AC output signal.
 - C. C_c blocks any DC component associated with the input from reaching the base. C_{bp} helps maximize degeneration of the AC output signal.
 - D. C_c blocks any DC component associated with the input from reaching the base. C_{bp} helps minimize degeneration of the AC output signal.

Correct answer: D

41. On a digital numerical display readout, what would be the minimum number of LED segments required to form and display any digit 0 through 9?
- A. 6
 - B. 7
 - C. 8
 - D. 9

Correct answer: B

42. As shown in figure "A" of the illustration, what type of converter unit is represented? Illustration EL-0240
- A. de-multiplexer
 - B. analog to digital converter
 - C. digital to analog converter
 - D. multiplexer

Correct answer: B

43. In process control terminology, continuously variable values which change without distinct increments, such as temperature, pressure, or level are correctly referred to as what type of values?

- A. digital values
- B. bumpless values
- C. analog values
- D. binary values

Correct answer: C

44. Which of the listed conditions describes the effect on intrinsic semiconductor operation as a result of a temperature increase?

- A. Conductivity will increase
- B. Capacitive reactance will decrease
- C. Resistivity will increase
- D. Inductive reactance will decrease

Correct answer: A

45. What is the functional purpose of a heat sink, as frequently used with transistors?

- A. to prevent excessive temperature rise
- B. to decrease the forward current
- C. to increase the reverse current
- D. to compensate for excessive doping

Correct answer: A

46. What does the circuit shown in the illustration represent? Illustration EL-0091

- A. oscillator
- B. function generator
- C. electronic overload relay
- D. voltage regulator

Correct answer: C

47. An ohmmeter used to test for front-to-back resistance of a PN junction diode should produce roughly what ratio?

- A. 100:1
- B. 500:1
- C. 1000:1
- D. 5000:1

Correct answer: A

48. If a digital multimeter is set up as shown in figure "B" of the illustration to test a capacitor, what would the display read if the capacitor was functioning properly? Illustration EL-0213
- A. the actual capacitance value of the capacitor will be displayed which should be within the tolerance range of the capacitor
 - B. initially a very low ohmic value will be displayed, followed by a gradual rise in resistance until a very high value is displayed (OL ohms)
 - C. initially a very high ohmic value will be displayed (OL ohms), followed by a gradual drop in resistance until a very low value is displayed
 - D. the charging voltage would be displayed which will initially be low and gradually rise to the internal battery voltage

Correct answer: A

49. What problem with a printed circuit board may resolve itself once a board is removed from its edge card connector and then reinstalled?
- A. Corroded pin connectors
 - B. Discolored or darkened components
 - C. Open traces or broken connections
 - D. Leaking components

Correct answer: A

50. For the purposes of shipboard practice, voltages above what threshold would be considered high voltage?
- A. 440 VAC
 - B. 1000 VAC
 - C. 4160 VAC
 - D. 6600 VAC

Correct answer: B

51. Some shipboard high voltage systems have the neutral point of the generators bonded to the ship's hull with a neutral grounding resistor. What is the purpose of this resistor?
- A. To maximize the magnitude of the ground fault current
 - B. To minimize the magnitude of the ground fault current
 - C. To completely eliminate ground fault current
 - D. To prevent nuisance ground fault trips

Correct answer: B

52. In order for a live-line tester to be used to test and prove dead a high voltage circuit, what must be done to verify the ability of the tester to detect a voltage?
- A. The live-line tester need not be checked prior to testing the circuit to be worked upon as long as it has not been declared inoperative.
 - B. The live-line tester should be checked by connecting to a known high voltage source only after testing the circuit to be worked upon.
 - C. The live-line tester should be checked by connecting to a known high voltage source only before testing the circuit to be worked upon.
 - D. The live-line tester should be checked by connecting to a known high voltage source before and after the circuit to be worked upon is tested.

Correct answer: D

53. When a high voltage system insulation test value is suspect or recorded during an annual survey, a polarization index test is performed. What is the polarization index?
- A. The polarization index is the insulation resistance taken at ten minutes.
 - B. The polarization index is the ratio of the insulation resistance taken at thirty minutes to the insulation resistance taken at one minute.
 - C. The polarization index is the ratio of the insulation resistance taken at ten minutes to the insulation resistance taken at one minute.
 - D. The polarization index is the ratio of the insulation resistance taken at one minute to the insulation resistance taken at ten minutes.

Correct answer: C

54. Overheating is suspected in a high voltage bolted bus-bar joint. If the local continuity resistance is to be checked off-line after the necessary safety precautions have been taken, what instrument would be used for the resistance test?
- A. A conventional ohmmeter
 - B. A special high resistance tester (megohmmeter)
 - C. A special low resistance tester (microhmmeter)
 - D. Any of the above ohmmeters would be suitable

Correct answer: C

55. Without the benefit of a specially designed enclosure window for thermographic analysis, what must be done to obtain accurate, but safe readings using infrared thermographic techniques?
- A. The infrared camera recording is taken immediately after de-energizing and isolating in accordance with safety procedures.
 - B. The infrared camera recording is taken after waiting a suitable period of time after de-energizing and isolating in accordance with safety procedures.
 - C. The infrared camera recording is taken before de-energizing and isolating in accordance with safety procedures.
 - D. The infrared camera recording is taken while energized with the enclosure door open in accordance with safety procedures.

Correct answer: A

56. What statement is true concerning random access memory (RAM)?
- A. RAM is volatile memory, and the contents of RAM are not lost when the power is removed.
 - B. RAM is non-volatile memory, and the contents of RAM are not lost when the power is removed.
 - C. RAM is volatile memory, and the contents of RAM are lost when the power is removed.
 - D. RAM is non-volatile memory, and the contents of RAM are lost when the power is removed.

Correct answer: C

57. What Ethernet cabling technology supports the greatest data transfer speeds?
- A. Thick Ethernet
 - B. Gigabit Ethernet
 - C. Thin Ethernet
 - D. Fast Ethernet

Correct answer: B

58. If a computer display is flickering, how may this be remedied?

- A. Increase the resolution bandwidth
- B. Decrease the resolution bandwidth
- C. Decrease the refresh rate
- D. Increase the refresh rate

Correct answer: D

59. What computer network device maintenance procedure is recommended to be increased in frequency when the equipment is located in areas of high vibration?

- A. Periodically blowing out equipment enclosures with compressed air
- B. Periodically checking the connections between devices and components
- C. Periodically testing network connections with network analyzers
- D. Periodically cleaning or replacing equipment enclosure air filters

Correct answer: B

60. A very useful Windows utility for discovering or verifying IP addressing information of a network is "ipconfig". How is this utility program launched?

- A. It is run from the command prompt screen by typing "ipconfig/all".
- B. It is run from the command prompt screen by default by simply bringing up the command prompt.
- C. It is run by clicking on the TCP/IP shortcut icon on the desktop.
- D. It is run by clicking on the "ipconfig" icon in start menu or under programs.

Correct answer: A

61. What is the name of a TCP/IP application run from the command prompt which provides routing information by determining the path through the network to a destination which is entered by the user?

- A. TRACERT
- B. FTP
- C. IPCONFIG
- D. PING

Correct answer: A

62. As shown in the illustrated block diagram for a digitized echo sounding system, what statement is true concerning the transmission and reception of acoustical energy? Illustration EL-0185

- A. The acoustical energy is produced as a continuous wave and transmitted from the transducer and the reflected acoustical energy is received by the same transducer.
- B. The acoustical energy is produced as a continuous wave and transmitted from one transducer and the reflected acoustical energy is received by a second transducer.
- C. The acoustical energy is produced as rapid, short high intensity pulses and transmitted from the transducer and the reflected acoustical energy is received by the same transducer.
- D. The acoustical energy is produced as rapid, short high intensity pulses and transmitted from one transducer and the reflected acoustical energy is received by a second transducer.

Correct answer: C

63. In mounting a transducer for a depth sounding system, what would represent an ideal location?

- A. Mount the transducer forward of the position where the bow wave re-enters the sea.
- B. Mount the transducer close to propellers but far away from sea water hull outlet openings.
- C. Mount the transducer far away from propellers but close to sea water hull outlet openings.
- D. Mount the transducer aft of the position where the bow wave re-enters the sea.

Correct answer: A

64. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 20 degrees left rudder, assuming left rudder signals are negative and right order signals are positive in polarity? Illustration EL-0191

- A. -2.25 VDC
- B. -4.0 VDC
- C. -5.0 VDC
- D. +5.0 VDC

Correct answer: C

65. As shown in the illustrated adaptive digital steering control system functional block diagram and listed system interface signals table, what would the rudder order signal output voltage to the rudder servo amplifier be for a rudder order of 15 degrees right rudder, assuming left rudder signals are negative and right order signals are positive in polarity? Illustration EL-0191

- A. -1.33 VDC
- B. -3.75 VDC
- C. +3.75 VDC
- D. +5.0 VDC

Correct answer: C

66. For the purposes of safety and determining the shock hazard, nominal voltage is defined as the normal electrical system design voltage. This can be determined from what is displayed on nameplates, data plates, schematics, or single-line diagrams. What does the nominal voltage represent?

- A. phase to hull ground voltage
- B. phase to neutral voltage
- C. phase to phase voltage
- D. average of phase to phase and phase to hull ground voltages

Correct answer: D

67. What is the minimum threshold voltage at which the skin offers no appreciable resistance to electrical current flow and is known as the "skin-puncture voltage"?

- A. 208 VAC
- B. 480 VAC
- C. 600 VAC
- D. 1000 VAC

Correct answer: C

68. When a self-excited alternator's field has lost its residual magnetism due to a prolonged idle period, it will fail to produce a voltage. Flashing the field is the procedure used to restore the residual magnetism. Using a 12 volt storage battery, how is this performed?
- A. The S+ and S- leads are disconnected from the alternator stator. The S+ lead is connected to the positive terminal of the battery, and the S- lead is connected to the negative terminal.
 - B. The F+ and F- leads are disconnected from the alternator field. The F+ lead is connected to the negative terminal of the battery, and the F- lead is connected to the positive terminal.
 - C. The F+ and F- leads are disconnected from the alternator field. The F+ lead is connected to the positive terminal of the battery, and the F- lead is connected to the negative terminal.
 - D. The S+ and S- leads are disconnected from the alternator stator. The S+ lead is connected to the negative terminal of the battery, and the S- lead is connected to the positive terminal.

Correct answer: C

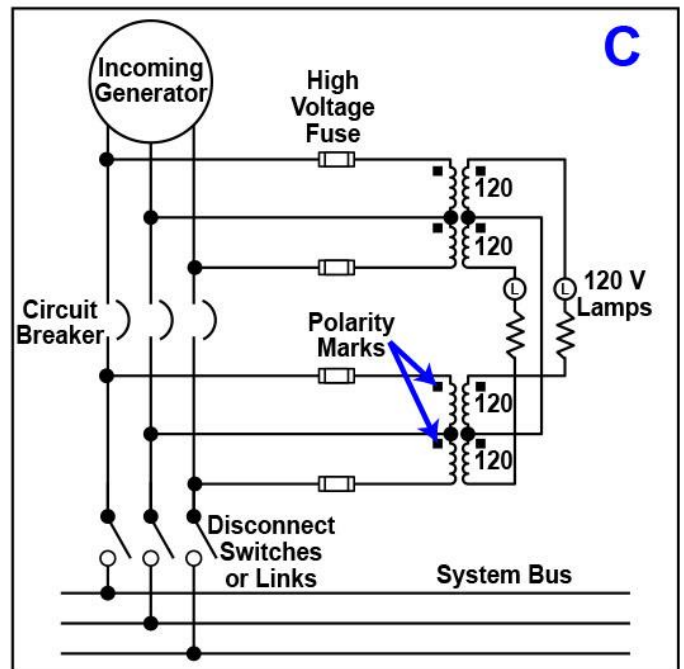
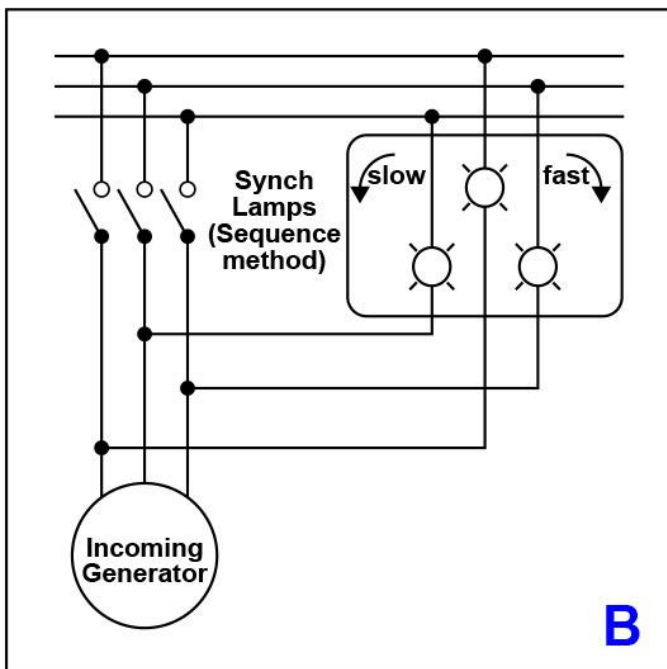
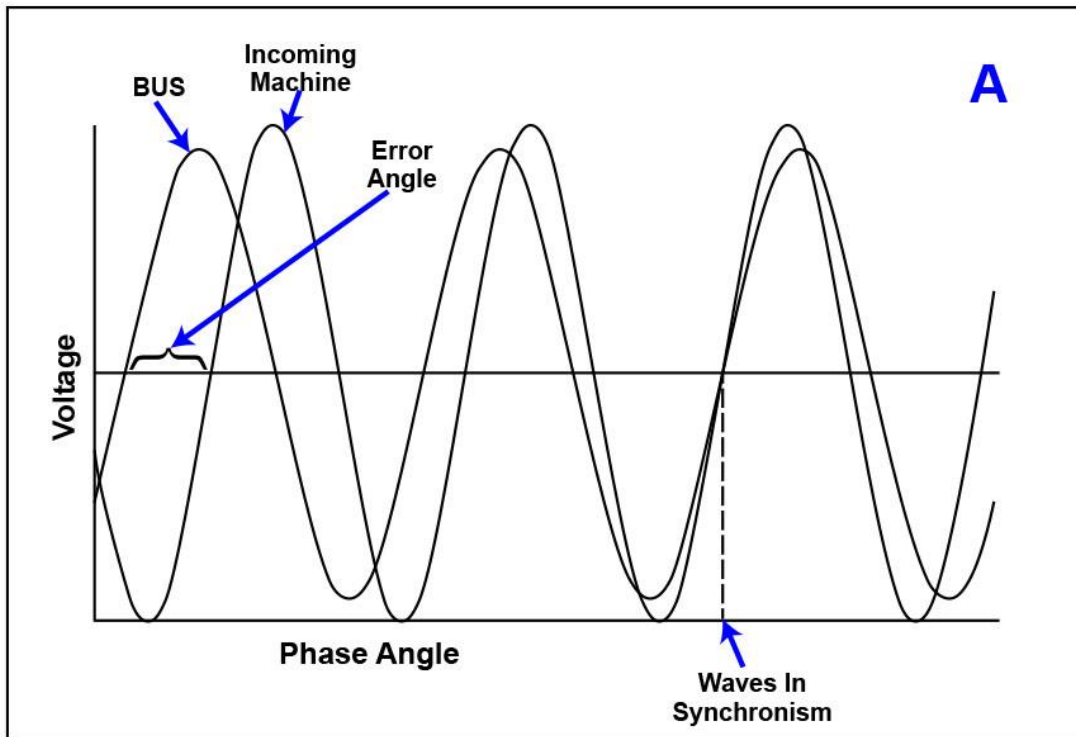
69. Upon failure of the normal power supply, how is the emergency generator placed on the line to feed power to the emergency bus?
- A. power failure alarm bus
 - B. automatic bus transfer device
 - C. main bus tie feeder
 - D. line connection feeder

Correct answer: B

70. While underway onboard a DC diesel-electric drive ship, you notice excessive sparking of the brushes on the main propulsion motor. What should be your FIRST action?
- A. decrease the speed of the main generator
 - B. decrease the main generator voltage
 - C. notify the bridge that you will need to slow down to reduce the electrical load
 - D. decrease the motor field current

Correct answer: C

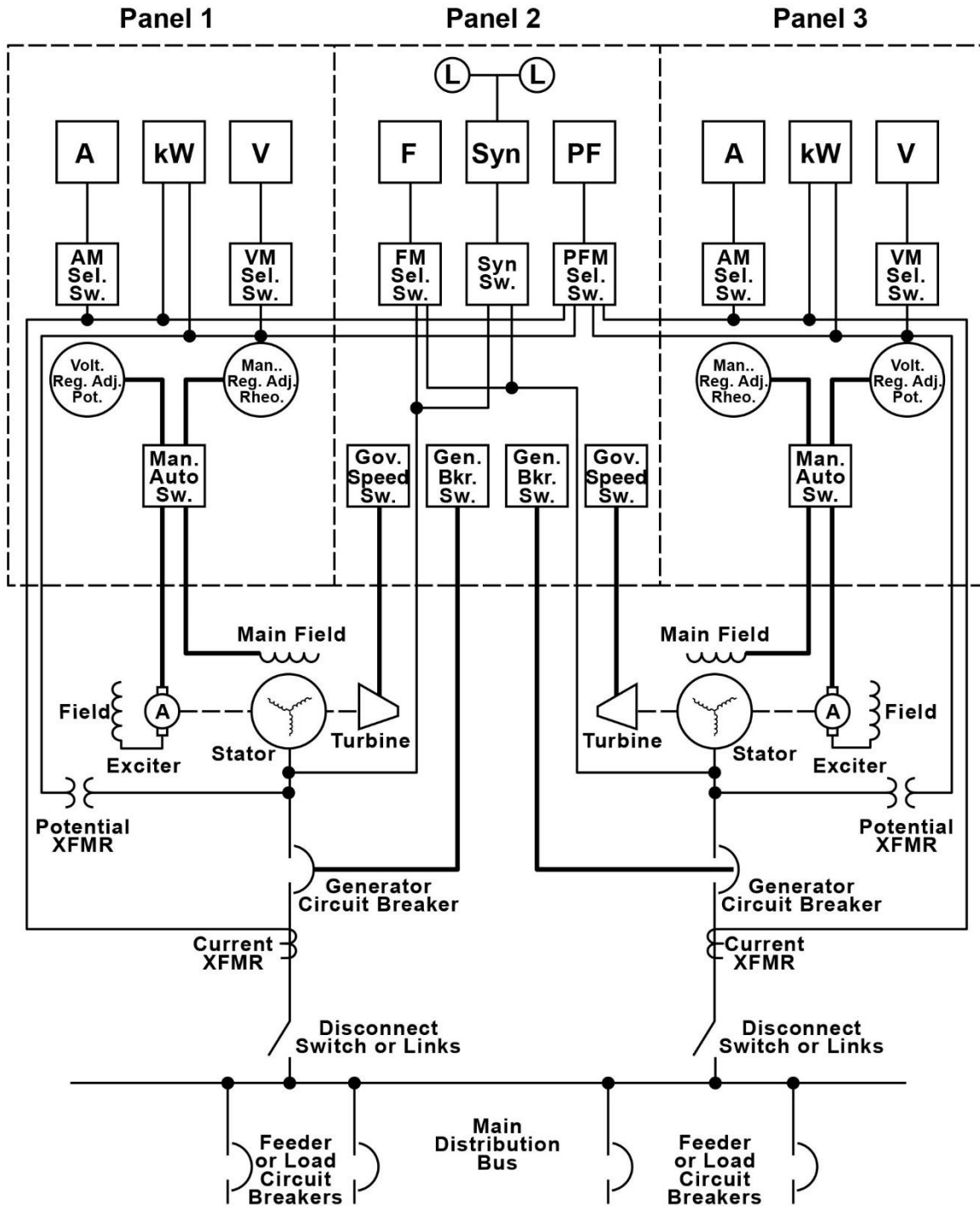
EL-0002



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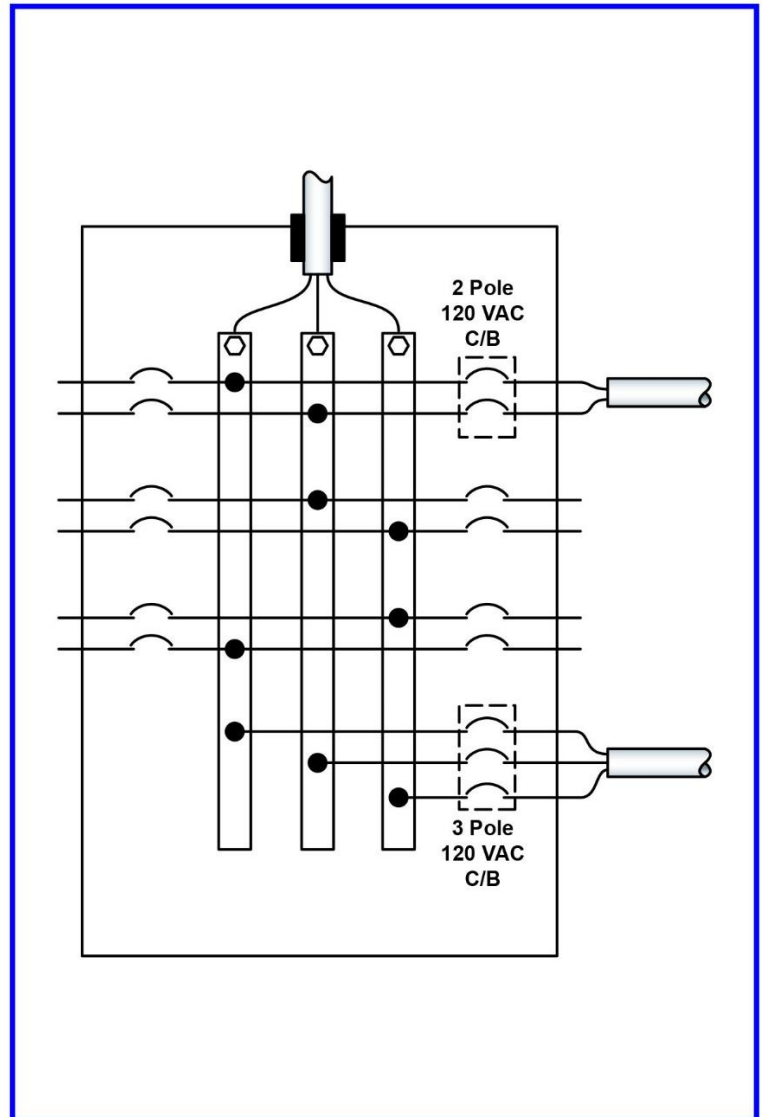
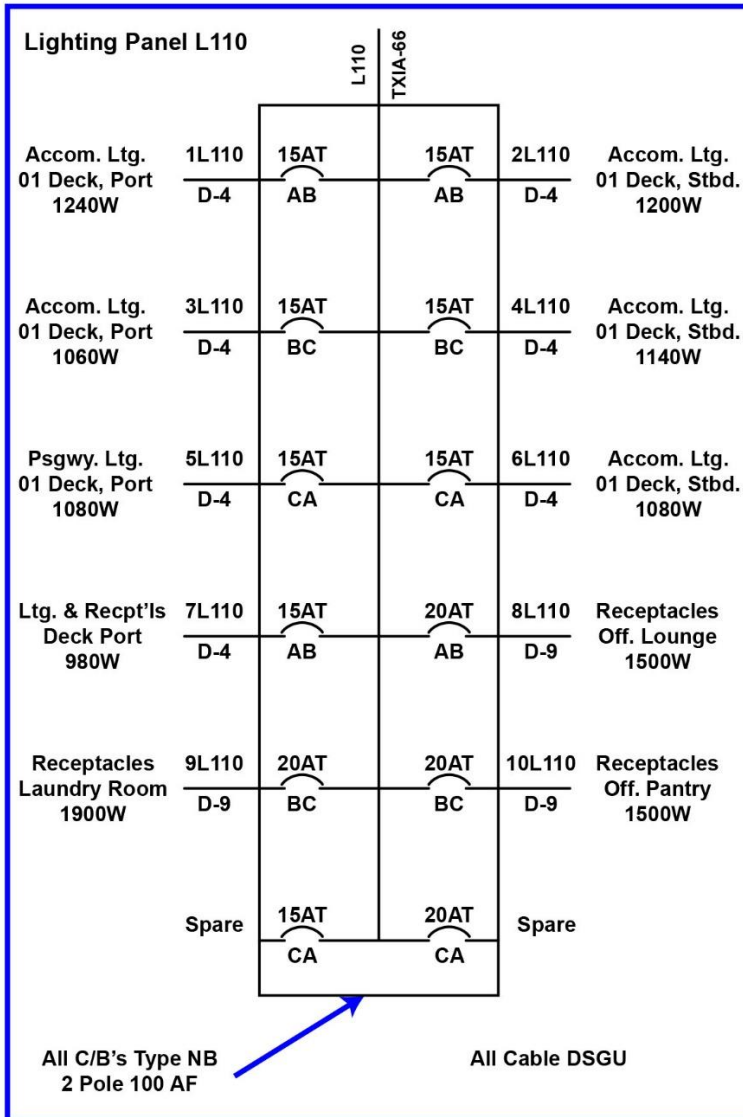
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EL-0003



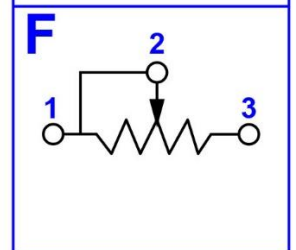
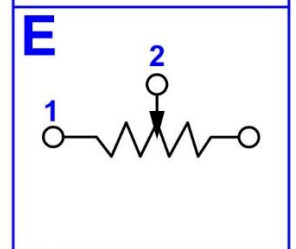
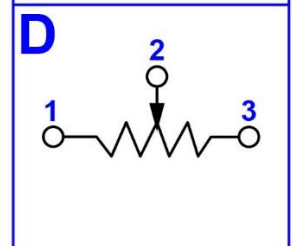
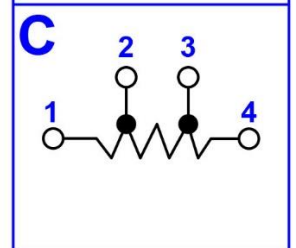
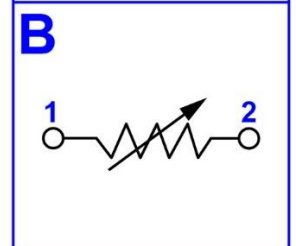
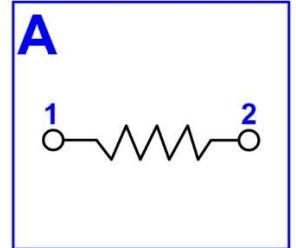
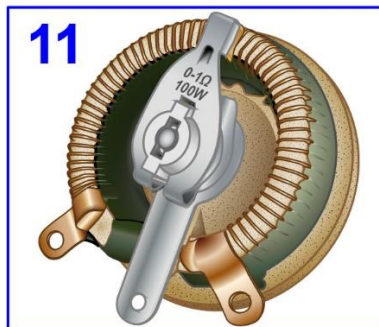
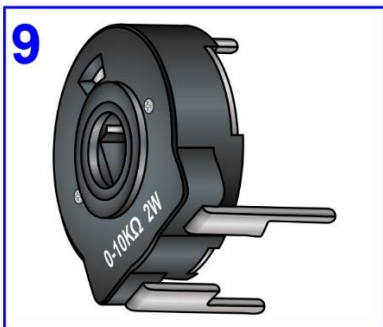
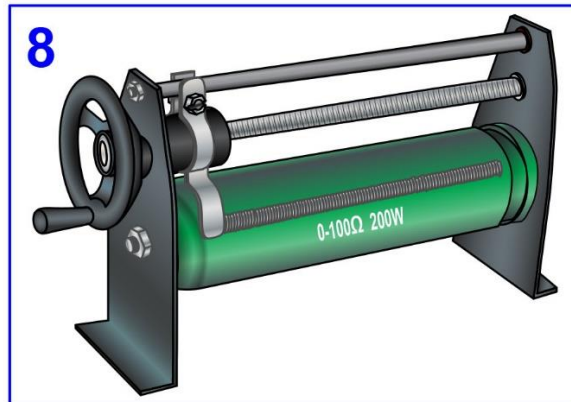
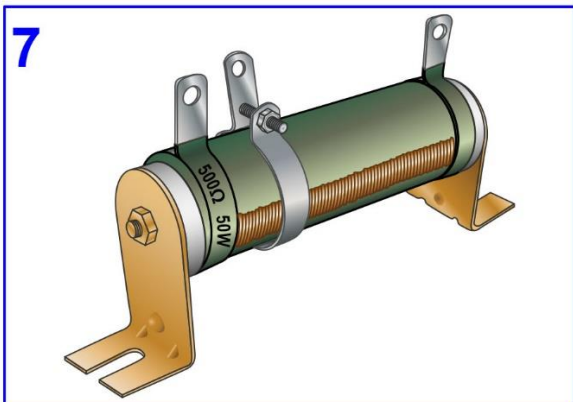
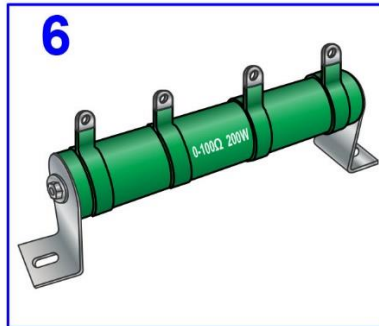
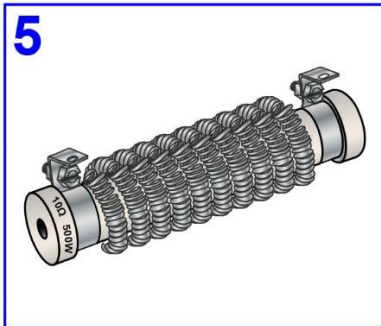
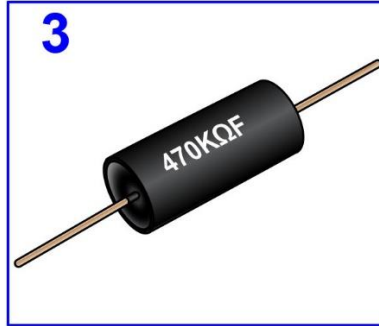
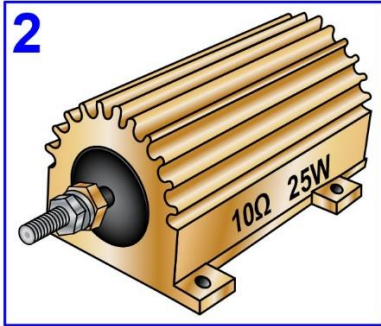
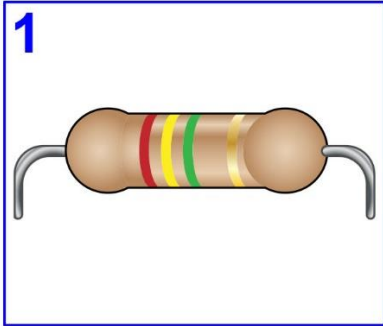
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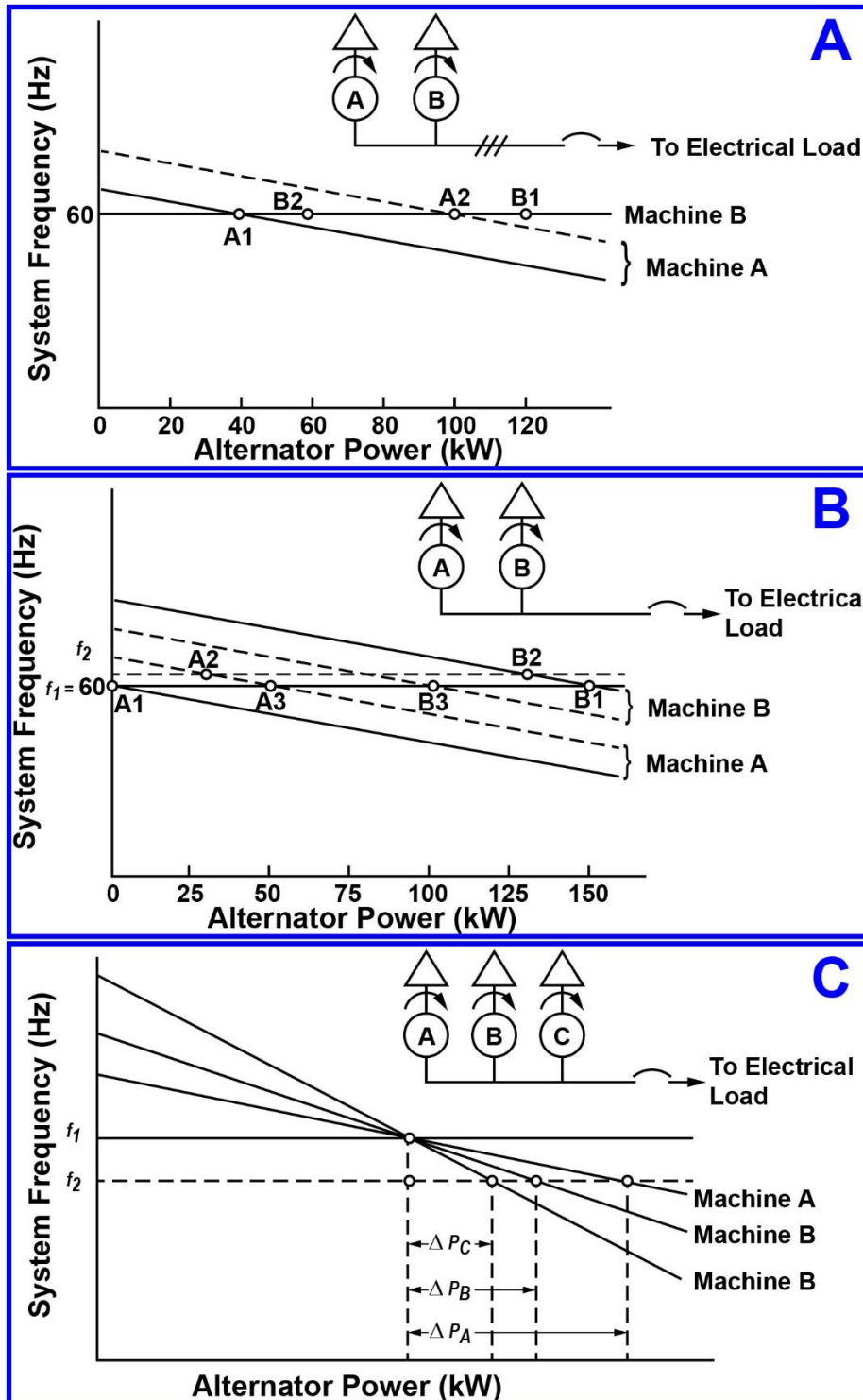
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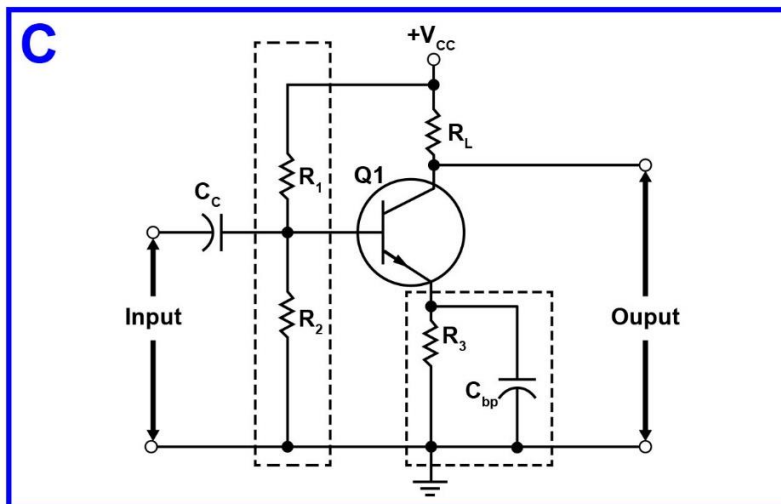
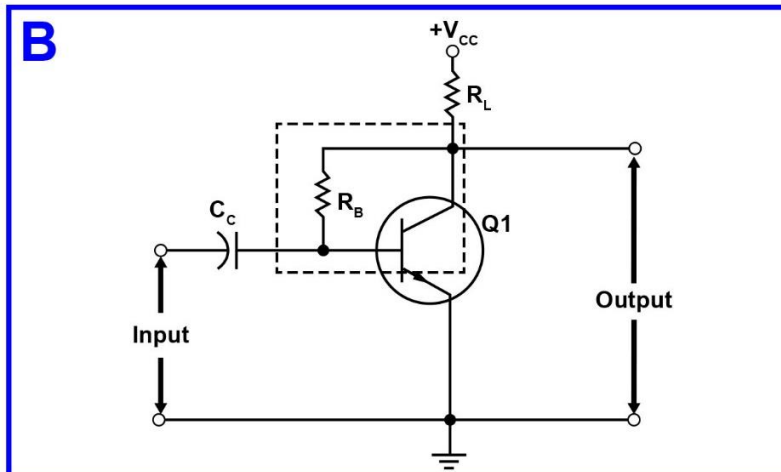
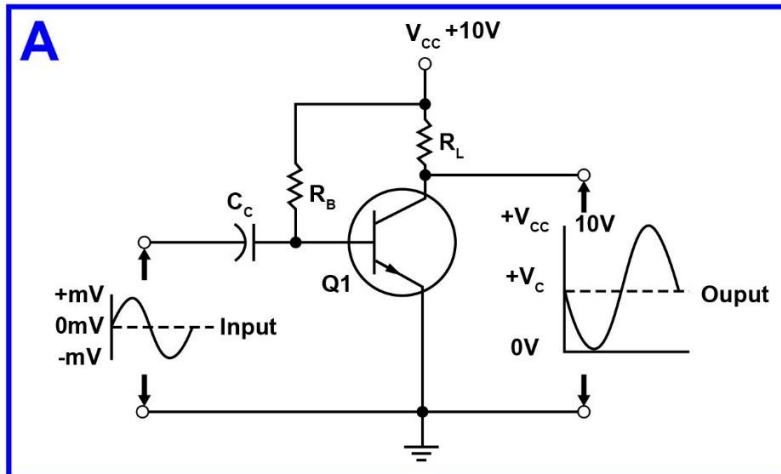
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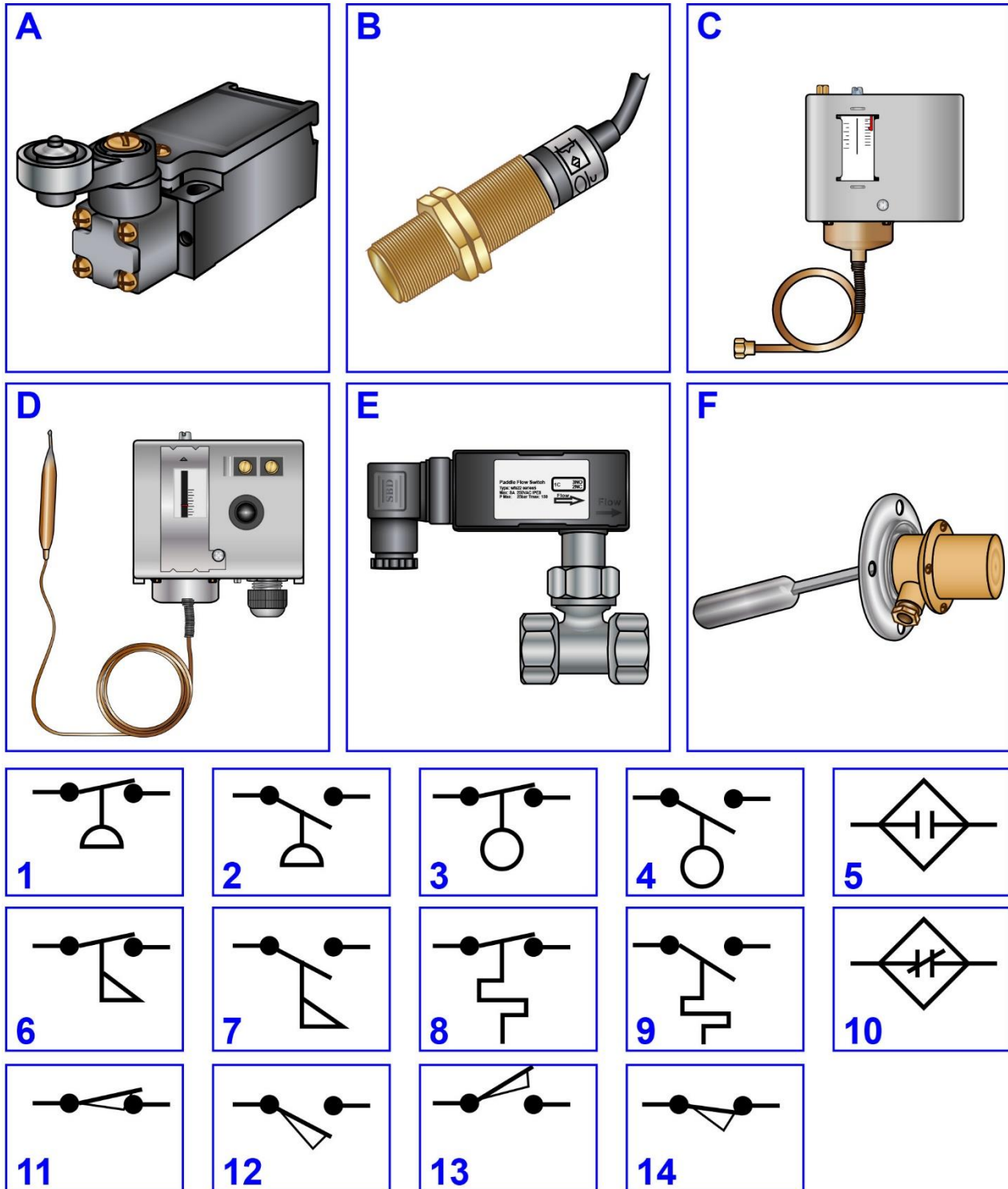
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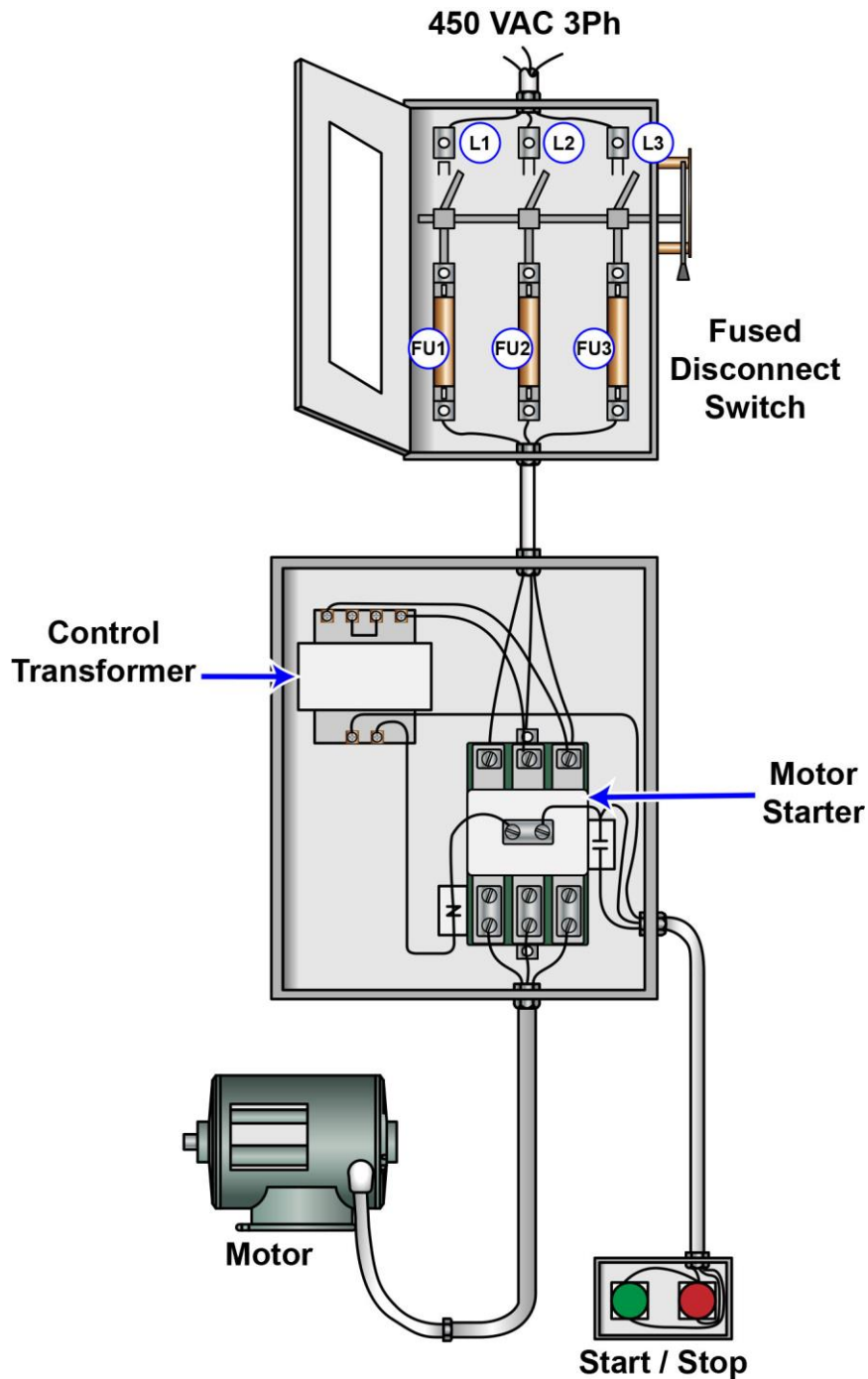


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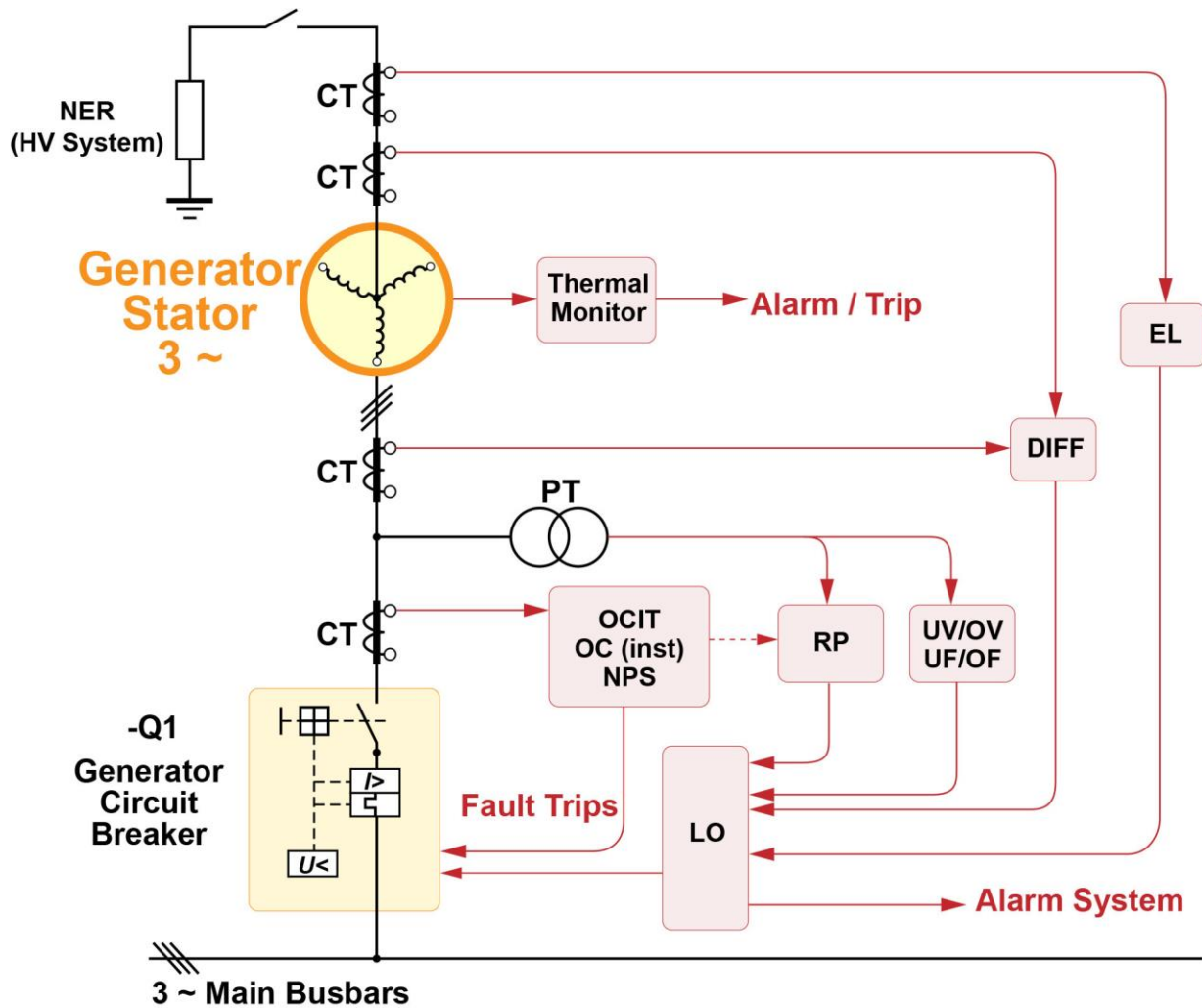


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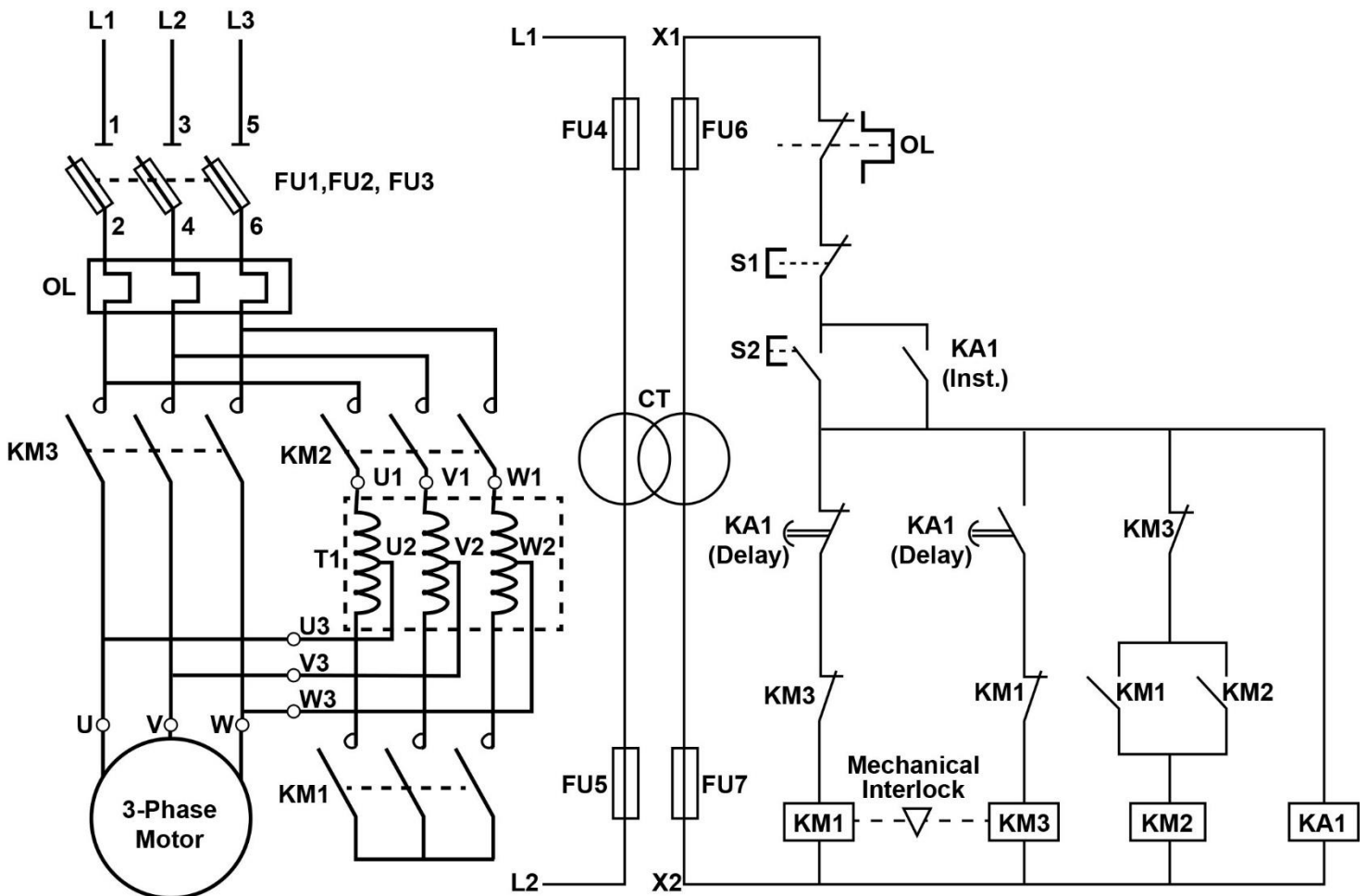
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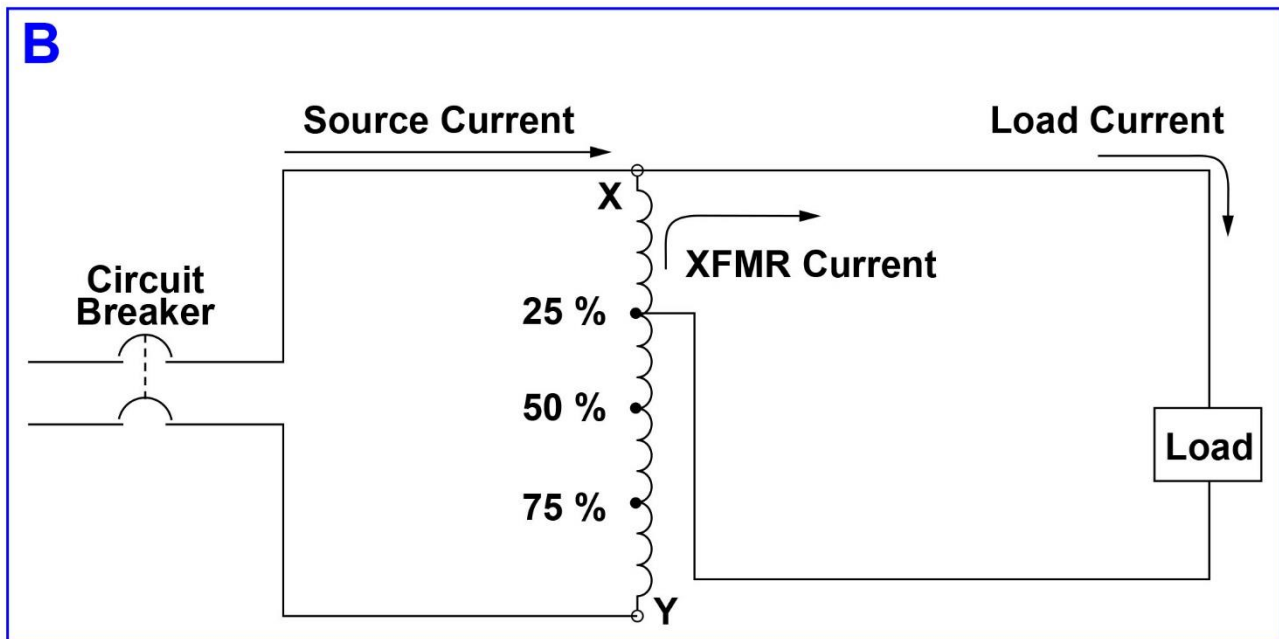
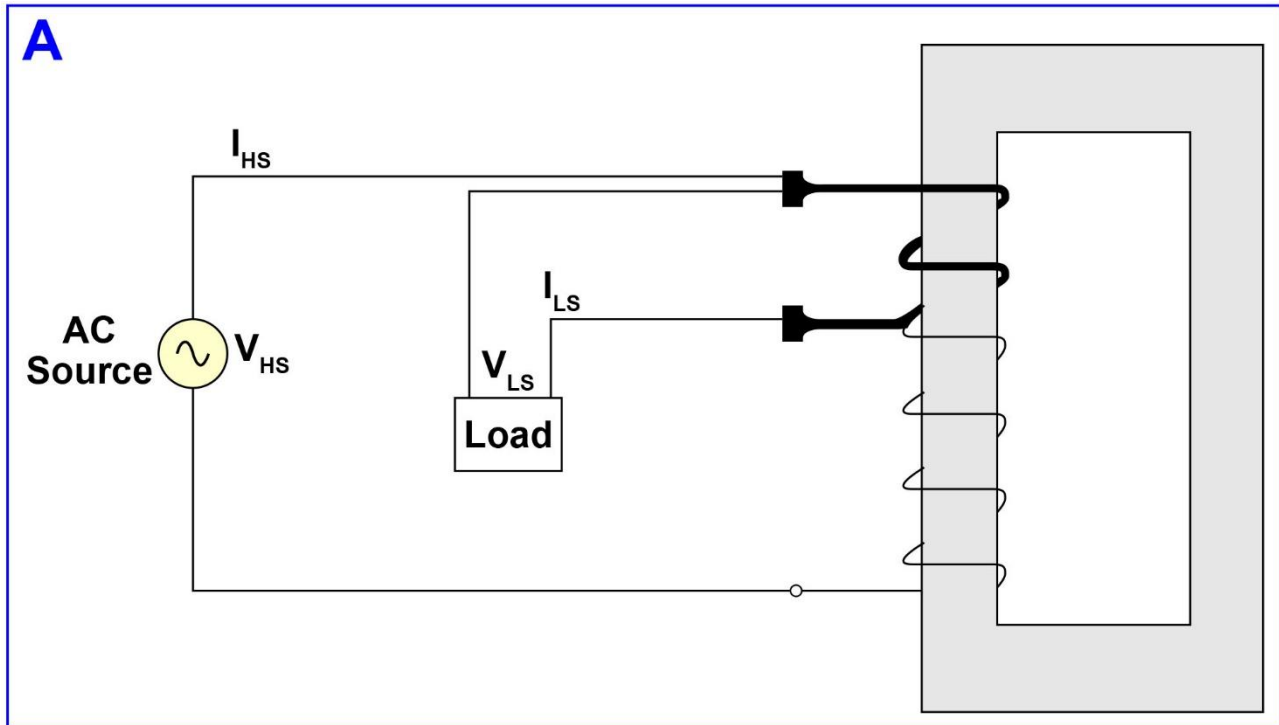


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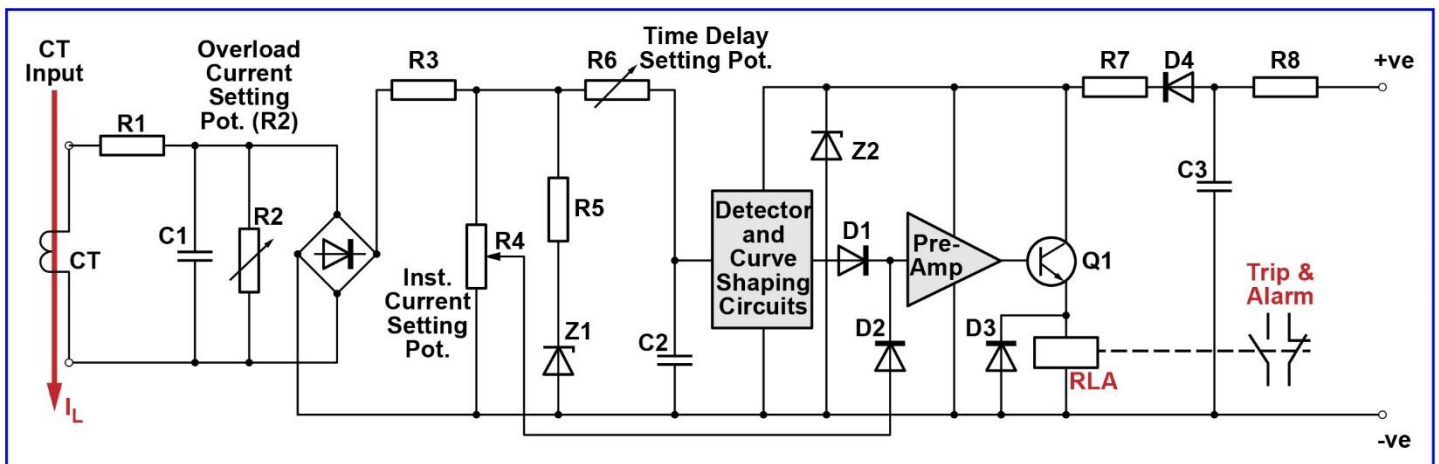
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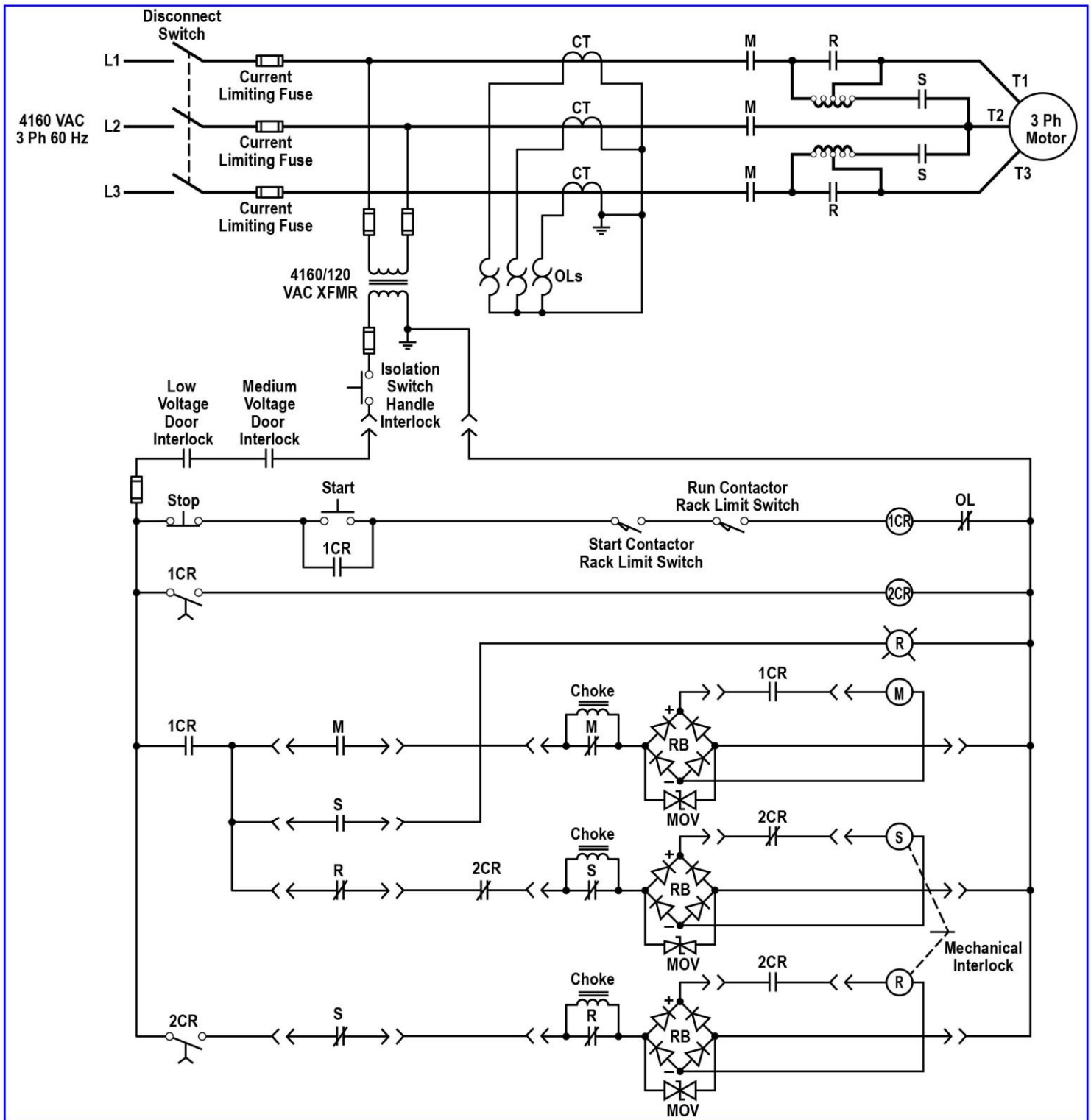


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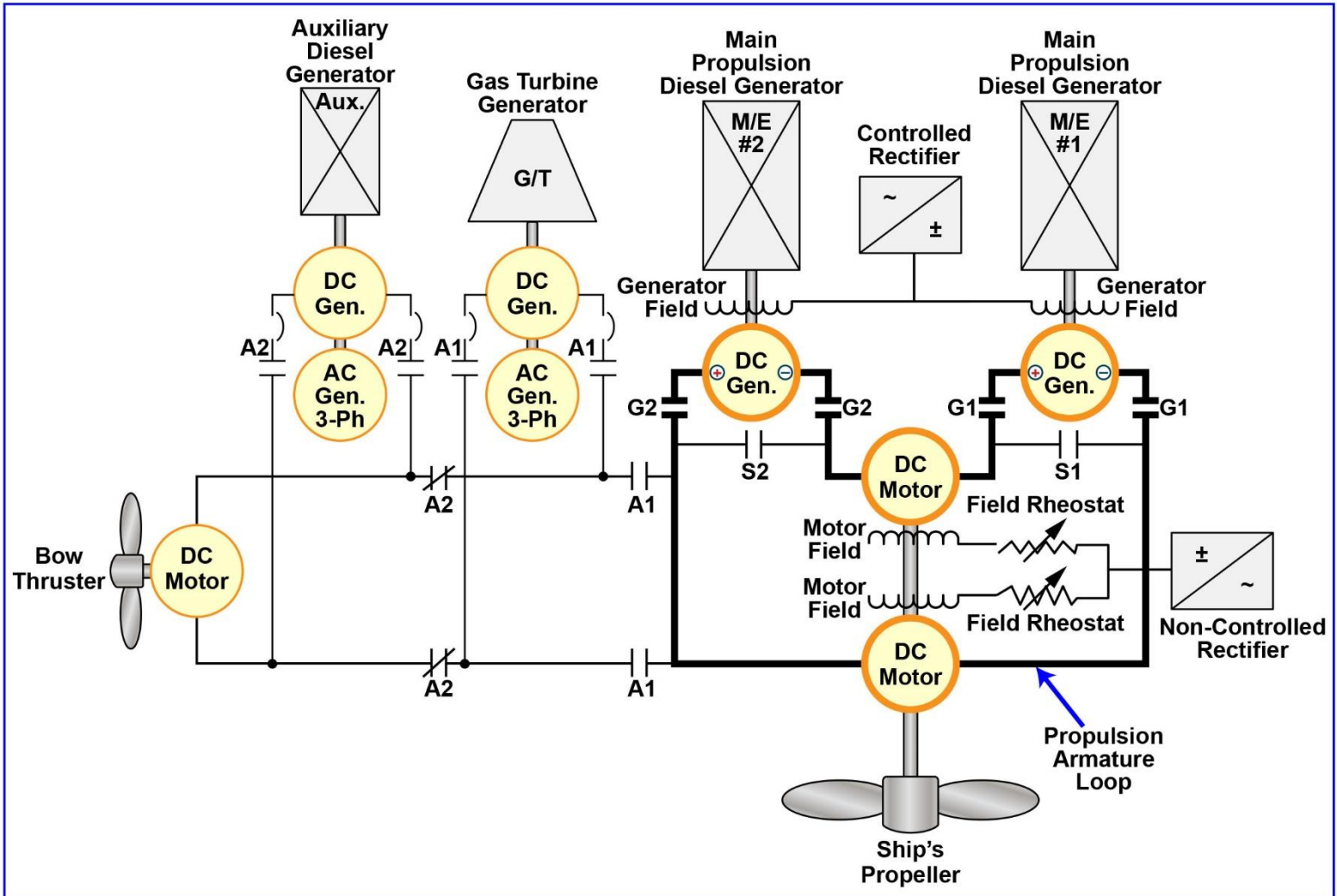
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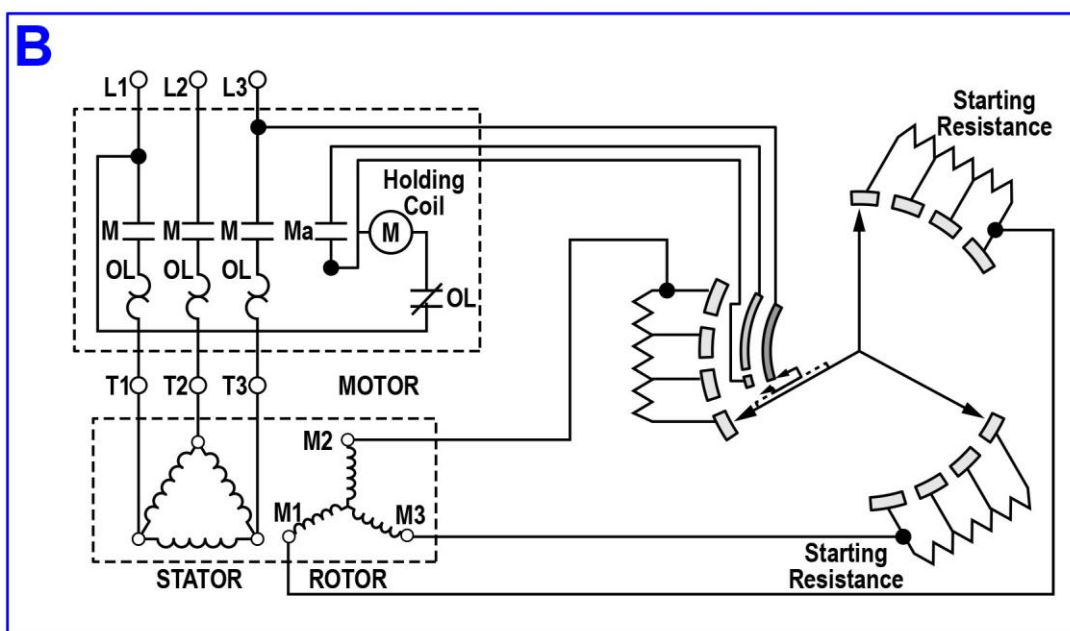
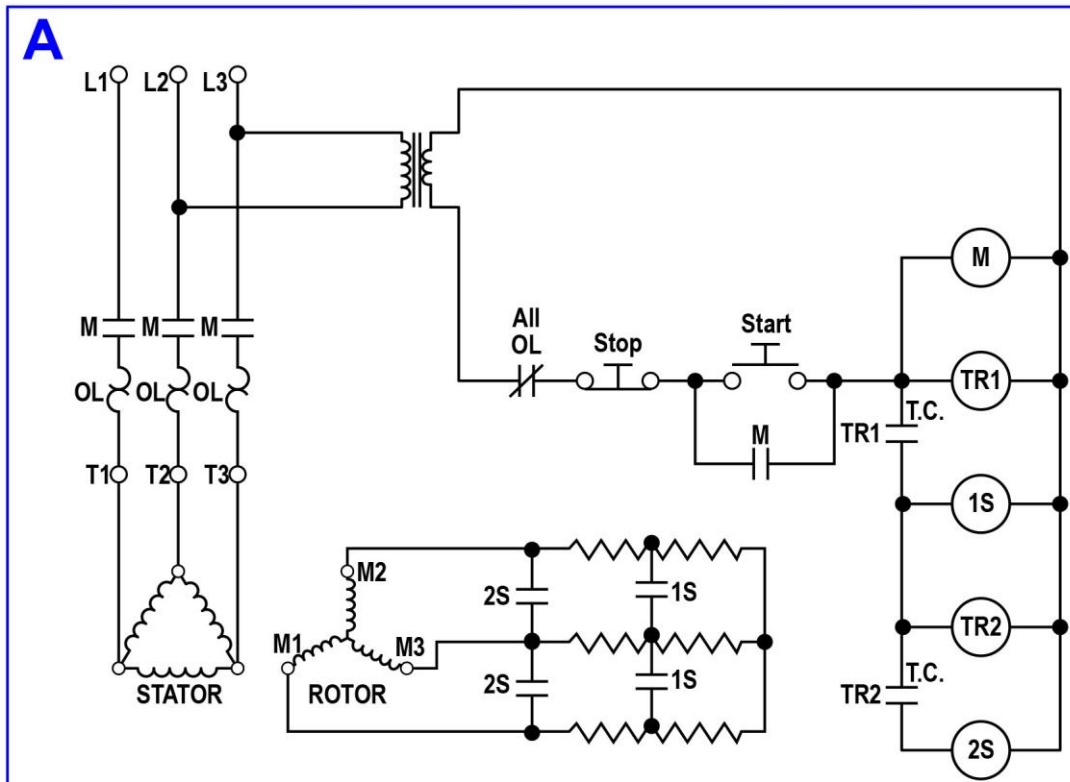
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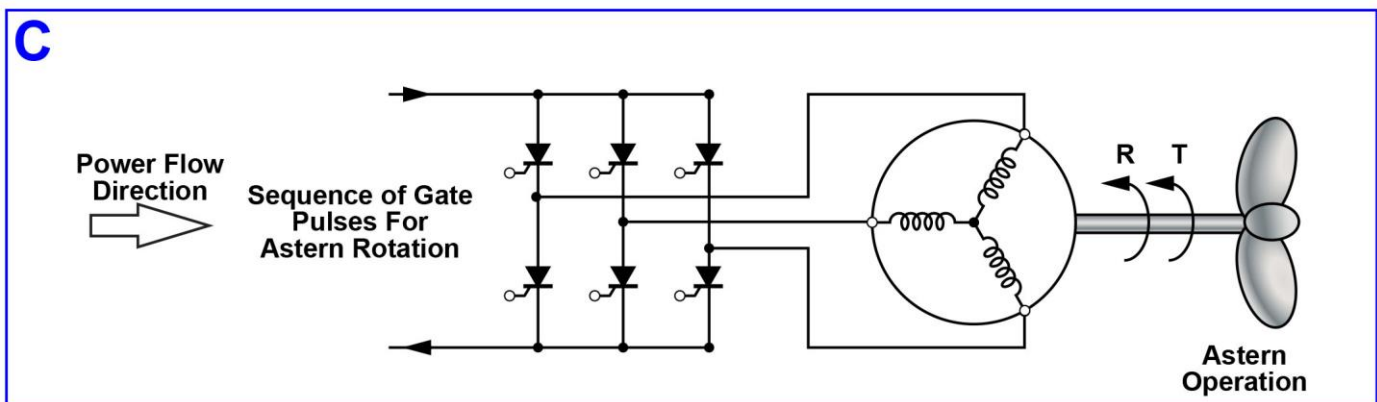
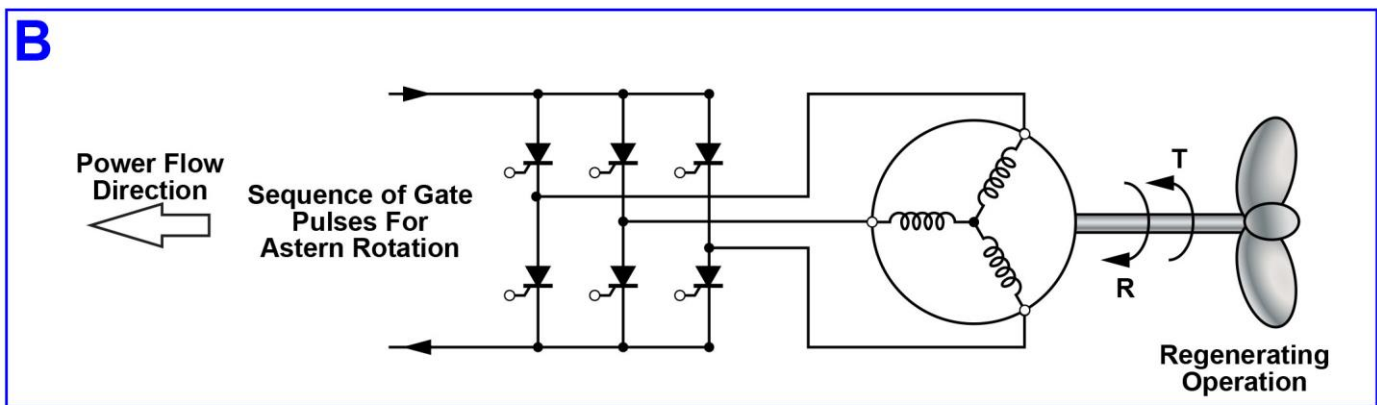
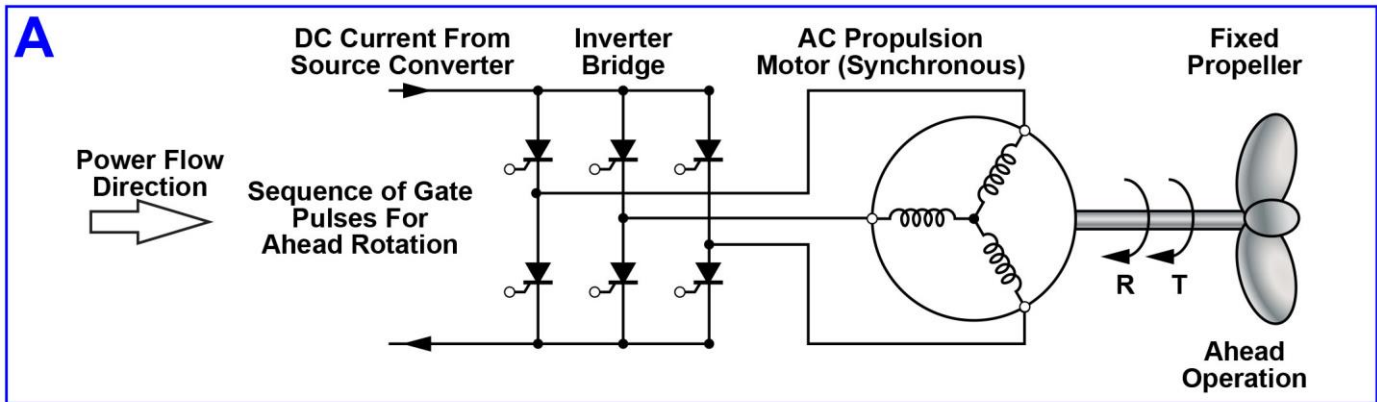
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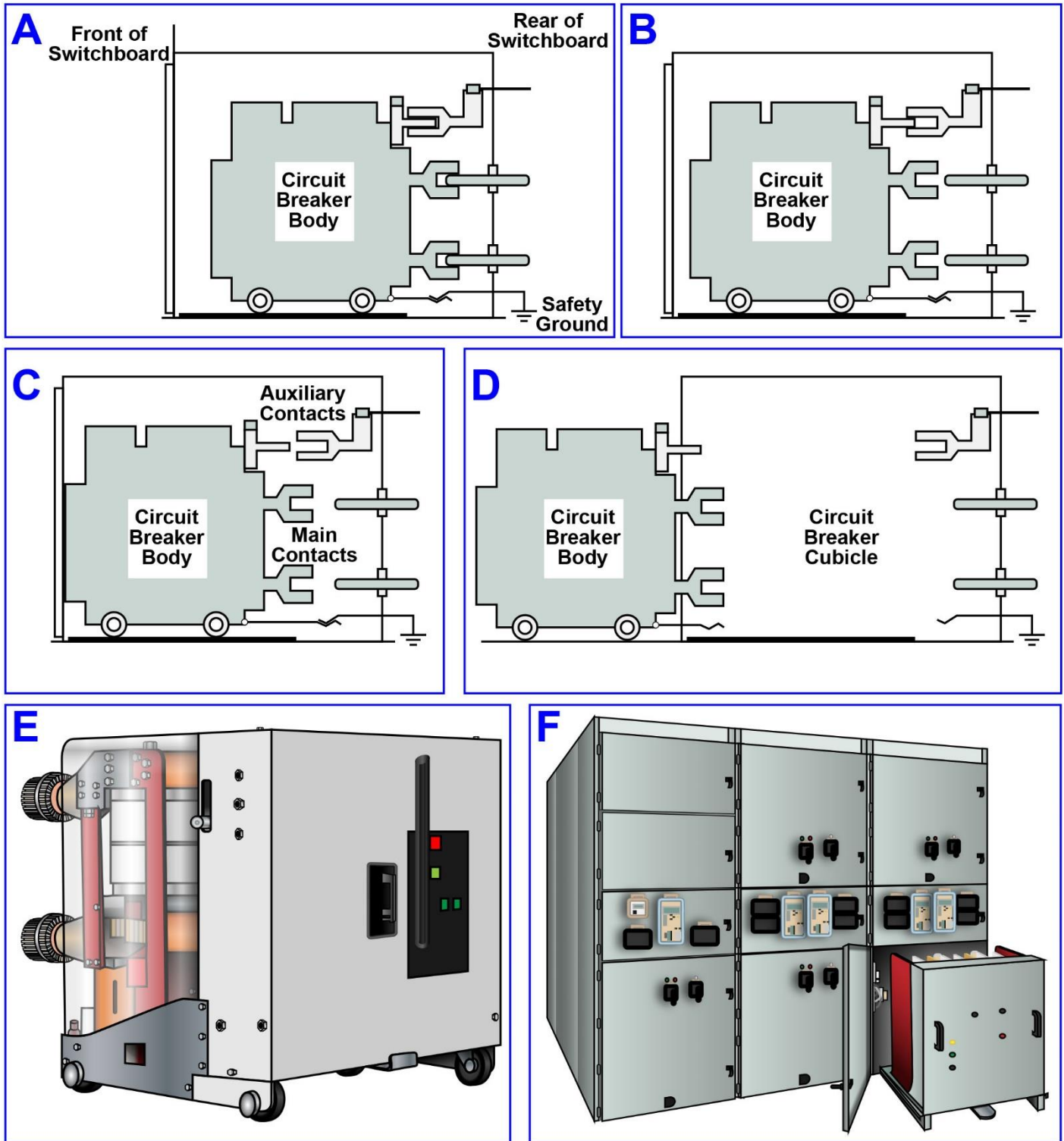
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Where R = Direction of Actual Rotation
T = Direction of Applied Torque

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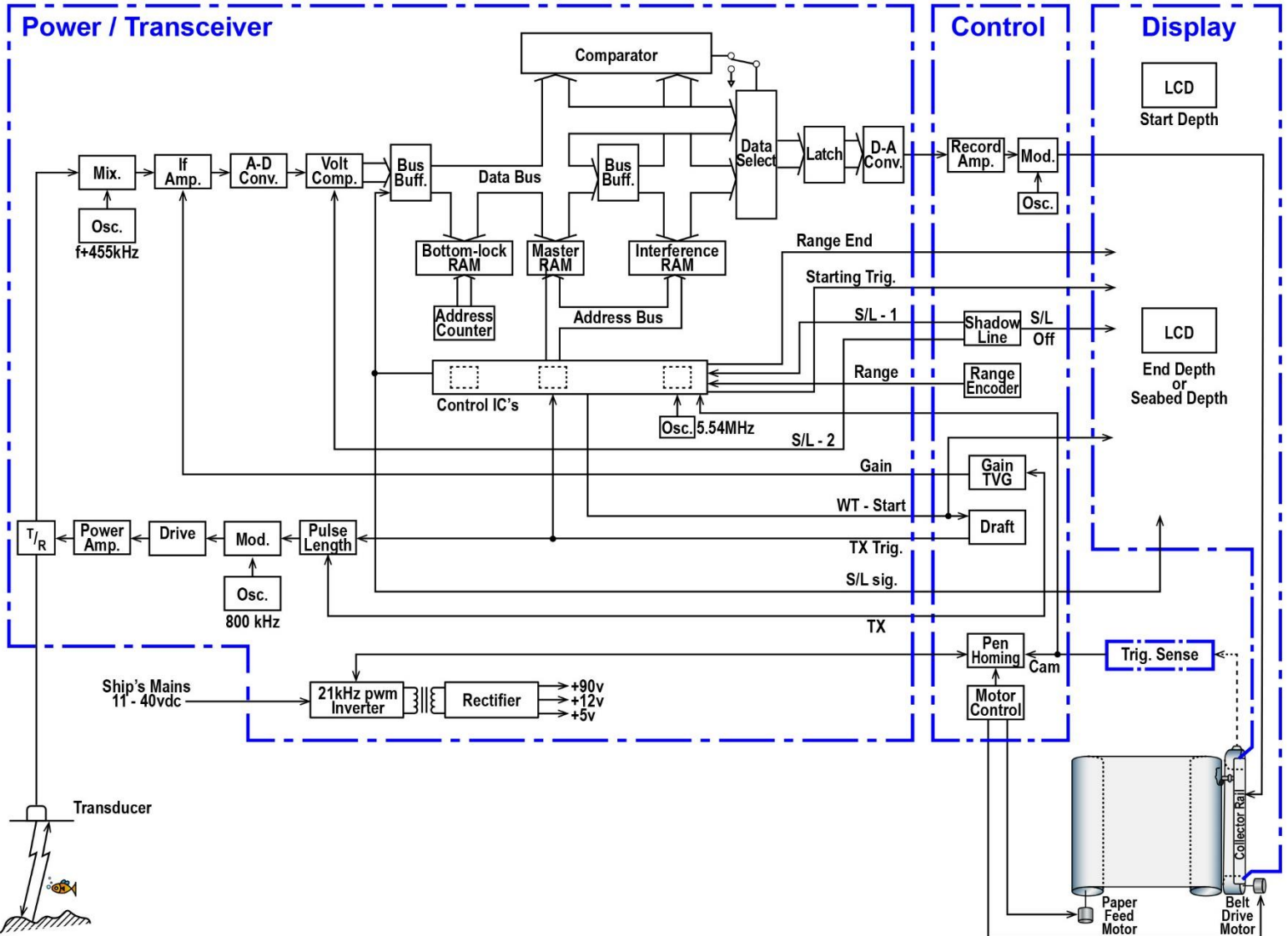


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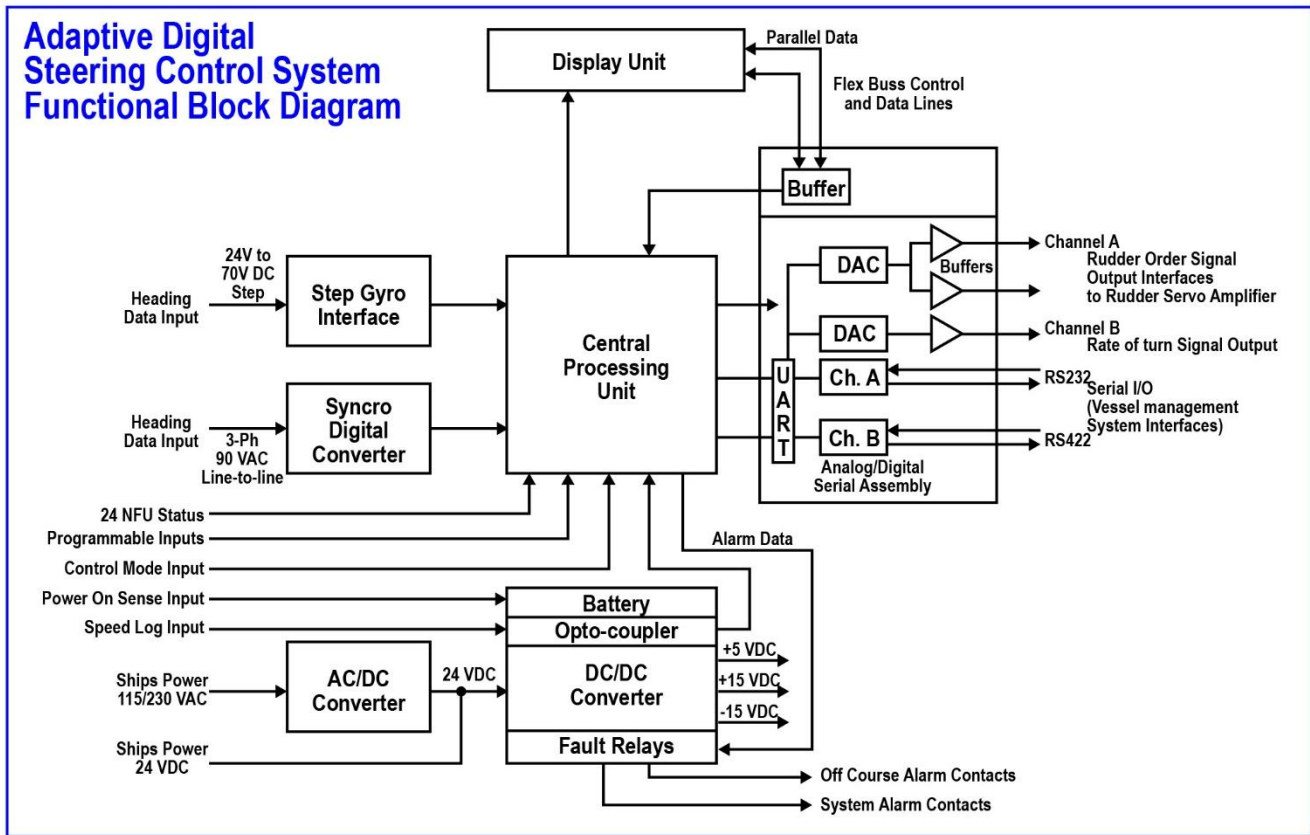
EL-0185 Digitized Echo Sounding System



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Adaptive Digital Steering Control System Functional Block Diagram

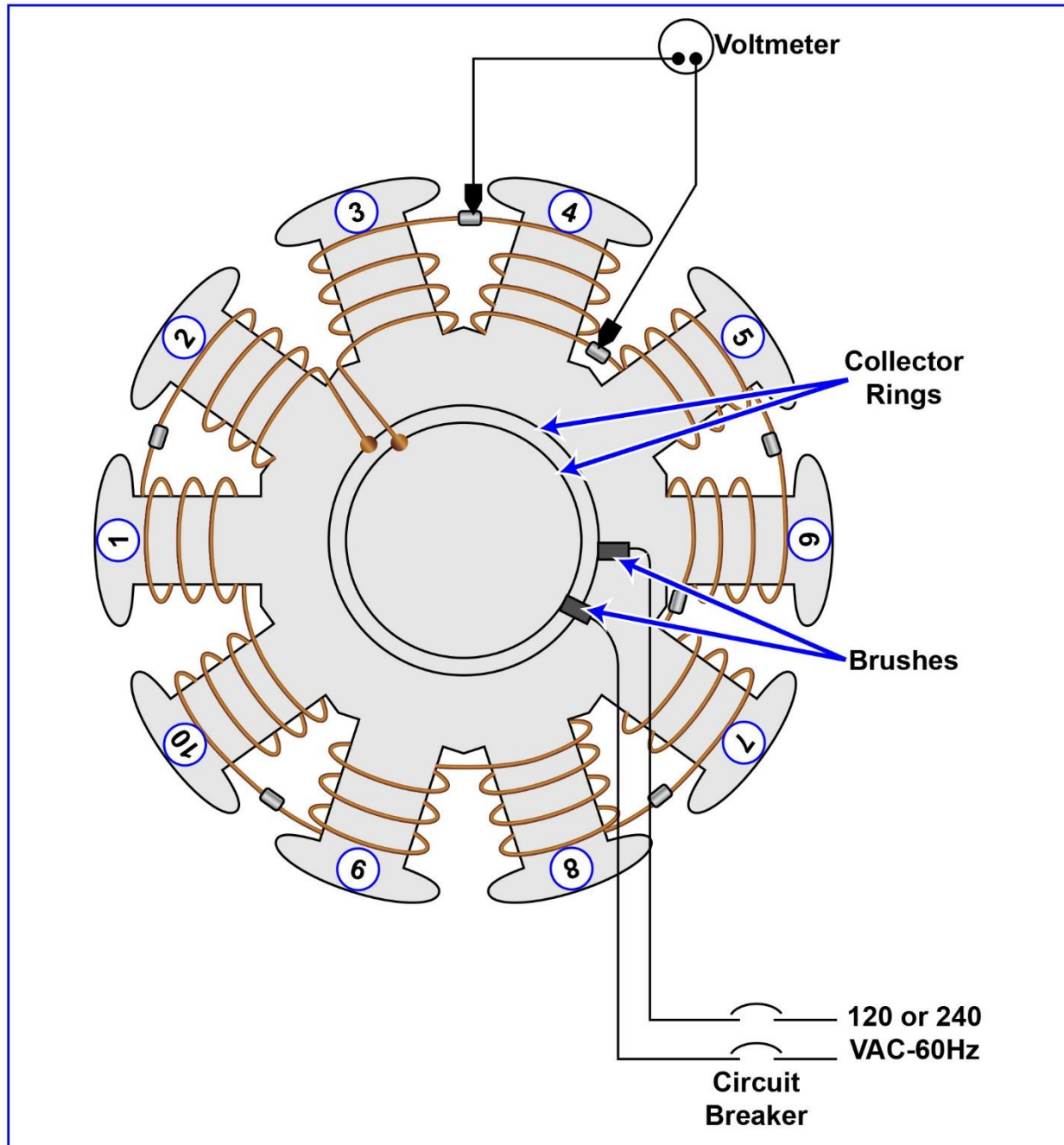


Adaptive Digital Steering System Interface Signals

Inputs	
Speed log input Pulsed Serial	200 pulse nautical mile (PPNMI) format (contact closure) RS-232 (channel A or C) or RS-422 (channel B) communications in NMEA 0183 format, \$VBW, \$VHW
Navigator (vessel management system) input	Serial data for heading order, rate order, and cross track error information in RS-232 or RS-422 communication on channel A, B or C, in NMEA format \$APB, \$HSC, \$HTR, \$HTC or \$XTE
Compass Step data Syncro	Positive or negative step data (24 or 70 V) 1X, 90X or 360X
Data Serial data	\$HDT (on channels A, B or C)
Mode switch sense contact	External switched opened or closed to inform autopilot to change from Standby mode to an automatic mode
NFU sense contacts	External contacts to indicate when the NFU Controller is active
Power failure circuits	Closed contacts on external power switch to activate power failure alarm
Outputs	
Interface to external rudder Servo control amplifiers	Bipolar analogue voltage proportional to the rudder order. ± 11.25 V (maximum limit) equal to $\pm 45^\circ$ or rudder
Rate of turn interface	Bipolar analogue voltage proportional to a turn rate indicator. ± 4.5 V (Max) equal to $\pm 90^\circ$ turn/min. Resolution equal to 0.5° /min.

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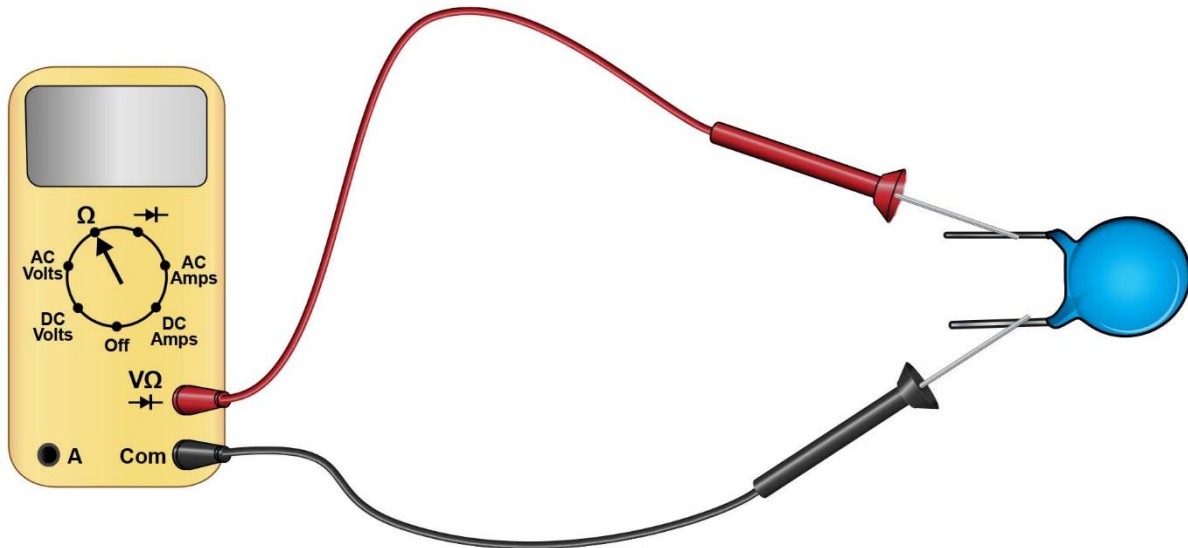
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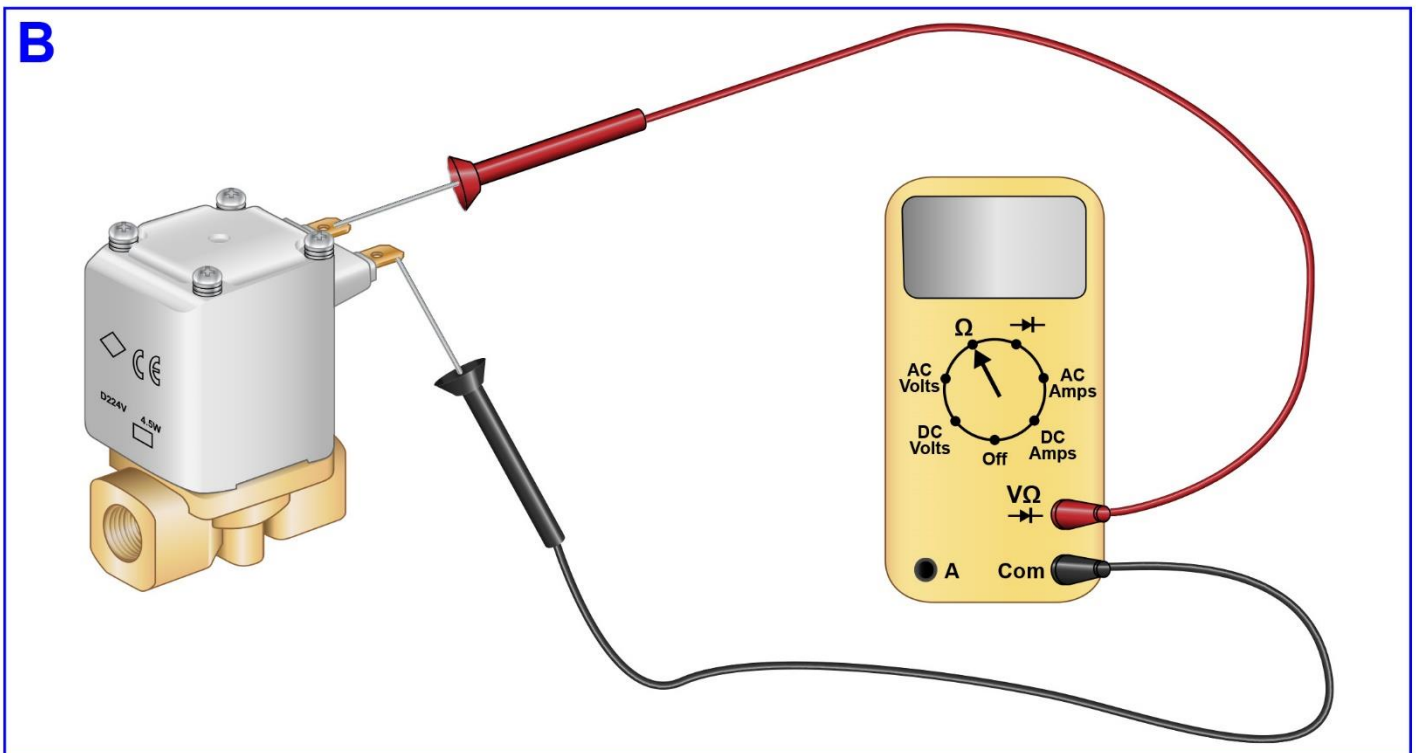
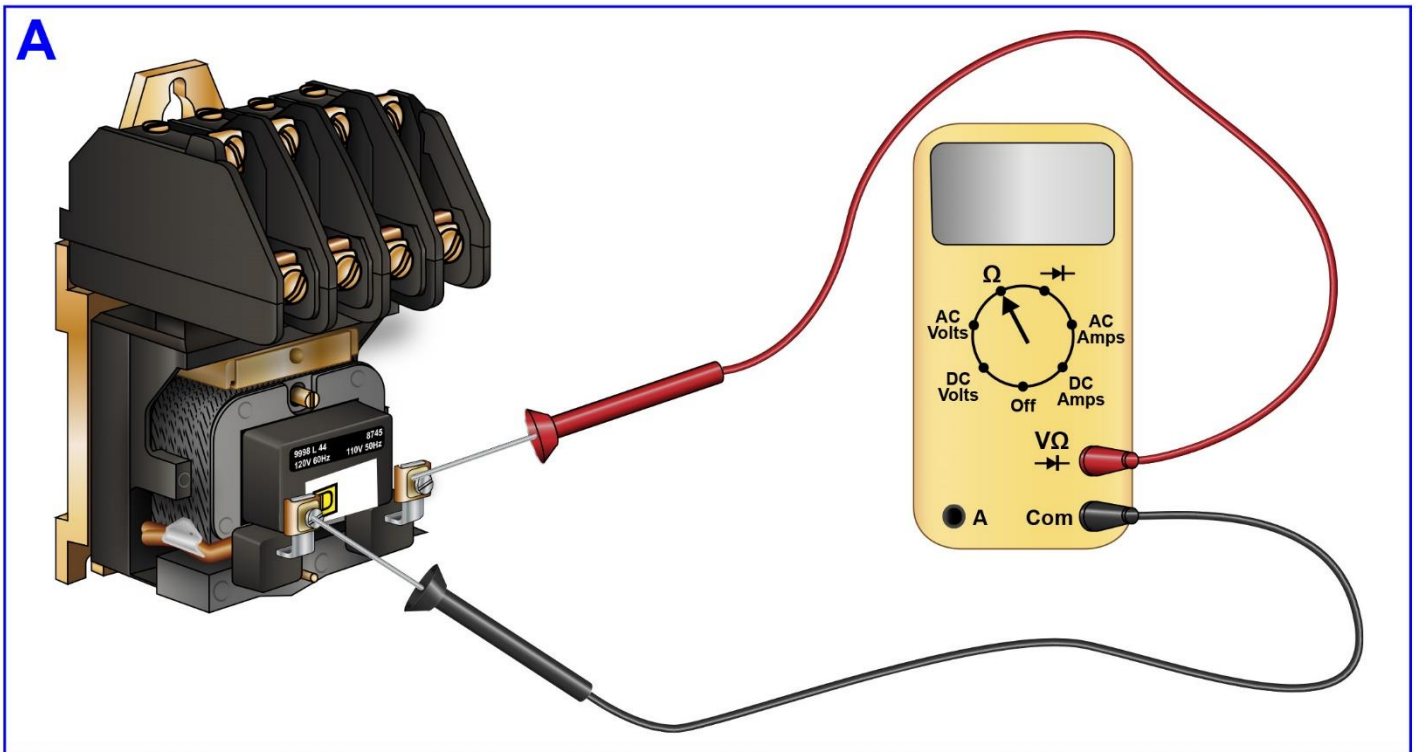
A



B

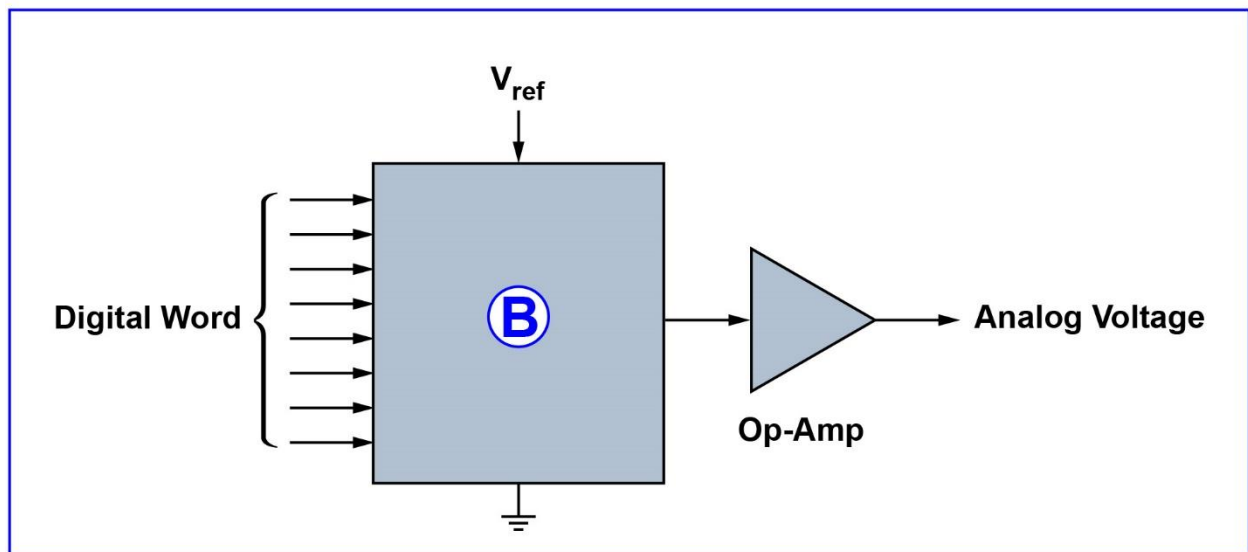
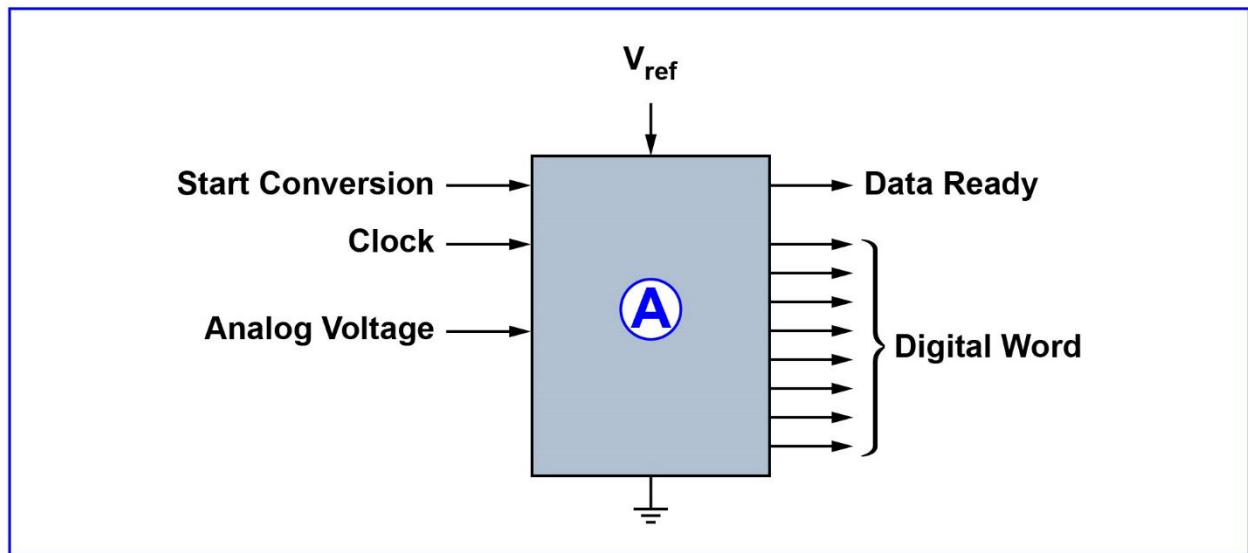


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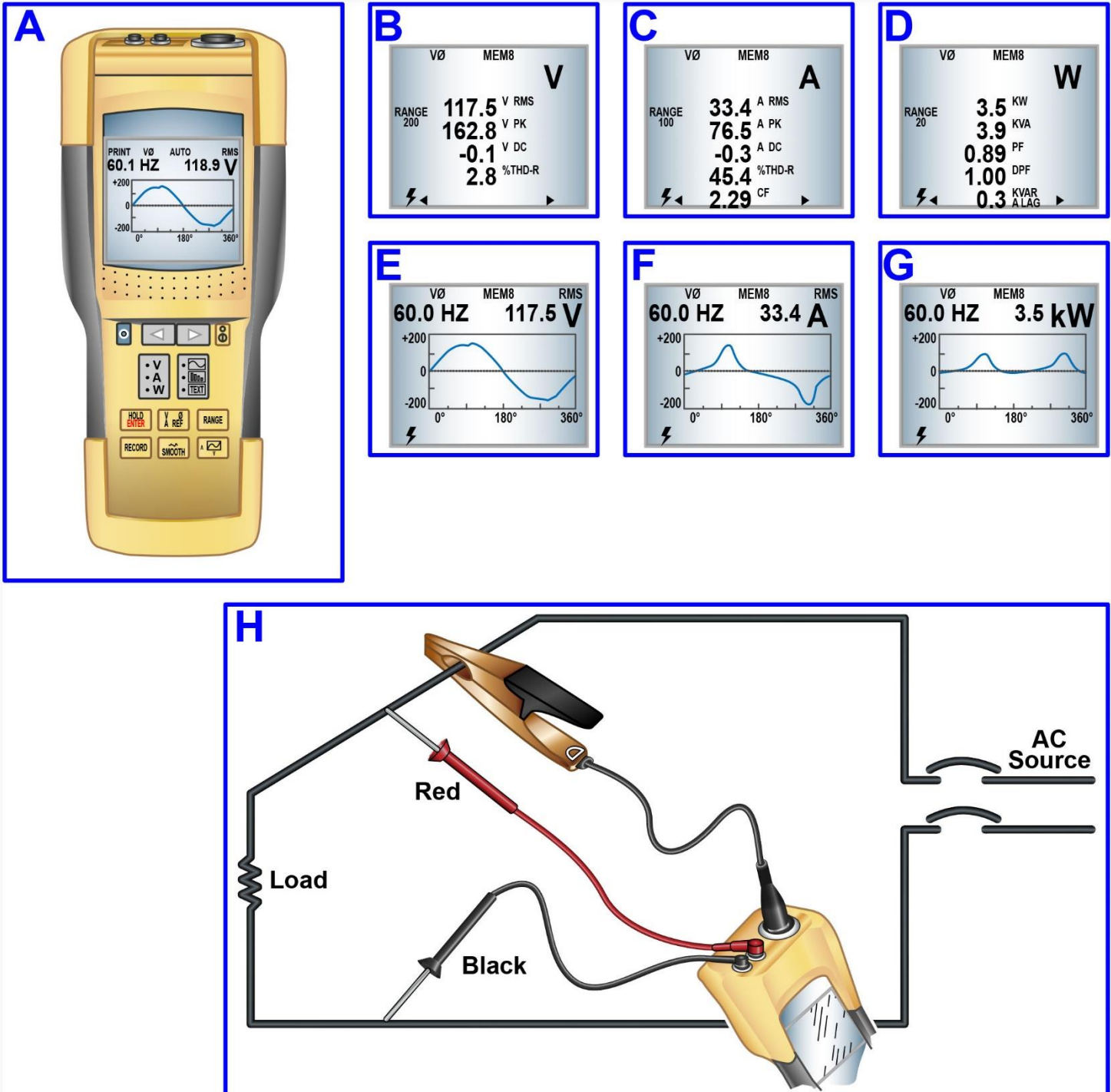
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